mind. If we didn't have thinking we wouldn't have school, boyfriends or girlfriends.

You use your brain to change events mentally.

I can think better in baseball and football because I talk to myself while I'm playing.

[illegible]
either closing their eyes and probing their minds for ideas that might help them [illegible] by just

# CREATIVE AND CRITICAL THINKING

A Study Completed for the Saskatchewan Department of Education, Core Curriculum Investigation Project

By

**Sandra Klenz,**
**Prince Albert School Division No. 3**
PRINCE ALBERT, SK

**June, 1987**

Some people reason things out by thinking about them in every way they can. Some people think by looking at something in their mind and putting that something in different places.

[illegible]
[illegible]
learned to communicate with themselves.

# CREATIVE AND CRITICAL THINKING
# AS COMMON ESSENTIAL LEARNINGS
# FOR SASKATCHEWAN SCHOOLS

A Study Completed for the
Saskatchewan Department of Education
Core Curriculum Investigation Project

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Prince Albert, SK

This document was written under contract with the Saskatchewan Department of Education. The views expressed are those of the author and do not necessarily represent the views of the Department.

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## EXECUTIVE SUMMARY

The central argument of this paper is that given the definition of education implied in the for Saskatchewan Goals of Education, (1984) and the fundamental requirements of a democratic society, creative and critical thinking are essential learnings. The extent to which they are learnings common to all subject areas is also affirmed.

A theoretical base for the paper is established in Chapter One. Concepts foundational to understanding critical and creative thinking are examined. These include establishing a coherent theoretical perspective upon education, learning, knowledge, intelligence, and purposes for critical and creative thinking. Education in Saskatchewan is taken to be ultimately a moral endeavor where concern for the future of the individual, for harmony within the global community, and for the survival of our planet is acted upon using reason and empathy, - creative and critical thought informed by the best knowledge available. Knowledge is considered to be constructed by humans, dynamic in nature and evolving from objective inquiry into the nature of our physical and social worlds together with influences from the history, interests, values and level of technology of the inquirer's time and place. Learning is developed as an interactive, synthesizing and not wholly understood process involving the learners' thoughts, feelings and experiences in ways that cannot be entirely separated. Language is felt to play a crucial role in learning and is an important vehicle for critical and creative thinking. Other symbols systems such as those provided by number, musical notation and the visual arts are important for both creative and critical thinking in the fields they are related to and also for insights into other fields. Critical and creative thinking are considered to be interrelated aspects of thought which have limited value used in isolation from each other. Commercially developed "thinking" programs are argued

to be incompatible with the intent of Saskatchewan's goals for education and the theoretical base of this paper.

Chapter Two examines critical thinking for its unique aspects and implications for curriculum development and pedagogy. Critical thinking is analyzed as including values, attitudes, skills and processes. The values underlying critical reflection include truth, fairness, justice, empathy, autonomy, rationality and self-criticism, while attitudes important to critical thinking are intellectual curiosity, open-mindedness, objectivity, intellectual honesty. persistence and respect for the viewpoints of others. Skills are considered to be best developed through their incorporation into the larger processes of critical thinking, - processes which involve dialectical reasoning. Appendix II outlines the skills and processes which support dialectical reasoning, but dialectical thinking is taken to be more than the sum of its parts. Rather it is seen as a goal to strive for. Critical thinking requires content for its employment and cannot be taught in the abstract. The criteria for its application vary from field to field because the evidence upon which knowledge is built differs in kind and method from field to field. The elements of critical thinking outlined above converge into the argument that critical thinking not be taught as technical skills delivered through commercial "thinking" programs but as integral aspects of knowledge development in each of the core subjects.

In Chapter Three creative thinking is discussed as a vague and culturally-shaped concept which receives further clarification through the analysis of its purposes and uses. Hemispheric specialization research is dismissed as a framework for curriculum development due to the relative newness of the field and its present lack of a comprehensive theoretical network including its implications for a theory of learning and applications for educational practice.

Creativity is examined through research into the lives and accomplishments of creative artists and scientists and some general pedagogical implications are drawn from their experiences. The constant inter-play between creative and critical thinking is stressed, as is the importance of a supportive climate for creative work. Elements of such an environment include provision of a depth and bredth of activities and assignments from which students may make choices in accordance with their unique talents and abilities and the fostering of self and peer critiques of the resulting processes and products. The development of standards which adhere to the moral principles of a democratic society but are not shaped by particular cultural, social or economic interests is also stressed.

Chapter Four summarizes the work of previous chapters and establishes a framework for curriculum revision congruent with the arguments of the paper. Recommendations focus upon development or revision of curriculum guides to support opportunities for critical and creative thinking within each of the core subjects and supportive re-structuring of our educational leadership, teacher training and internship policies and programs. While these recommendations are presented below as an overview of the direction taken in this paper, Chapter Four provides a more comprehensive discussion of their intent together with concrete examples or models for curriculum revision.

## LIST OF RECOMMENDATIONS

Recommendation 1: Critical and creative thought processes should be developed for each subject area in ways that reflect their interrelatedness and the unique contribution they can make to that area.

> 1a. The attitudes and values of the critical and creative person should permeate the curriculum, the teacher's methods and the school ethos and be understood by school teachers and administrators. This understanding should include how these attitudes and values relate and overlap with those developed under Social and Personal Values and Independent Learning.

Recommendation 2: As a basis for critical and creative thought, curriculum revision should be undertaken in each subject area and (in some cases) sub area, to include an understanding of the epistemology of the field to which it is related. Development of this understanding should begin at Grade Four and continue to Grade 12.

2.a Curriculum revision should include study of major contributors to a field (e.g.) Newton's contributions to Physics together with some discussion of his methods for theory formulation in relation to the predominant ideas of his era; Darwin's methods and contributions to Biology; the contributions of the French Impressionists to the visual arts, etc. Such study should build understanding of how these theorists or artists changed the field or the course of human life and lead to insights into how knowledge in that field has continued to evolve.

2.b Revision of teacher training "methodology" courses should be undertaken (where necessary) to correspond with this epistemological emphasis and should include examination of supportive pedagogy including the focus for questioning outlined in the rationale above and the use of debating and journal writing.

Recommendation 3: Curriculum revision should be undertaken in all subject areas which de emphasizes the single text approach (even more forcefully than has been the case in the past), supports the practice of selection from an array of credible sources, and which provides concrete information for critical practice and development of creative thought.

3.a: In order to support a multiple-source approach curriculum guides in each subject area, at each grade level, need to include a complete annotated bibliography of support materials including reference books, magazine articles, filmstrips, films etc. which are readily available. This bibliography needs to be updated yearly and should include references for teachers' use as well as sources which are at a level appropriate for students.

3.b: A model unit should be included in every curriculum guide which lays out in full: the potential sources of substantive content; appropriate pedagogy or forms of presentation; range of questions and projects for journal writing, class discussions, assignments and student evaluation practices; and, the integration possibilities within the unit. (If we are serious about decreasing teacher dependence upon textbooks and workbooks, we need to provide them with as much support as possible in developing alternative practices.

3.c: An appendix devoted exclusively to teacher questioning and discussion-fostering practices which support critical and creative reflection should be included in each guide. While Joan Tough's (1979, 1981) books on the development of language and thought in young children are excellent sources for such curriculum development in K - Grade 3, no single sources can be recommended for middle or secondary levels where questioning practices will be much more dependent upon the individual subject matter.

3.d: Model units should also incorporate examples of how metaphoric and analogical thinking can be used to create insights and build understanding in all of the subject areas. (Some sources for curriculum developers would be Sanders & Sanders (1984), Teaching creativity through metaphor) and Roukes (1982), Art Synectics.

Recommendation 4: An extensive review of all present or future curriculum guides should be undertaken with the specific intent of eliminating overlap and repetition and paring content to its most essential elements.

Recommendation 5: Conceptual analysis of each subject area should be undertaken and "key concepts to be understood" specified as part of each curriculum guide.

Recommendation 6: Development of one integrated curriculum guide for science, social studies and health should be considered for K to Grade 3 as an alternative way to allow for the new balances of time presented in the Core policy proposals. (Reducing Language Arts time has not been seen as "acceptable" by many teachers and parents.)

Recommendation 7: English and Language Arts Curriculum revision should be incorporate an increased focus on whole language practices particularly in Grades 1 to 6 and should include full development of these practices in model units.

Recommendation 8: Debating should be incorporated into curriculum guides from Grades 7 to 12 along with specific information to aid teachers in understanding the skills, techniques and attitudes involved.

Recommendation 9: Journal writing should be considered an important part of communication across the curriculum and of Language Arts from Year two and up.

Recommendation 10: A media unit should be included in language study at each level beginning with Grade 4. Such units should incorporate a focus on the skills listed in Appendix II.

Recommendation 11: Where Social Studies is developed as one subject, curriculum developers must attempt to foster understanding of the unique fields which it encompasses through inclusion (beginning in grade 7) of separate epistemogolical frameworks for history, geography, sociology, psychology, philosophy and economics. Integration of Social Studies' understandings with other fields related to the area of concern and with current social issues and students' experiences should continue to be developed.

Recommendation 12: Curriculum revision in Social Studies curricula (beginning in grade 7) should be undertaken to include the study of ethics and moral philosophy.

Recommendation 13: History curricula and textbooks should portray the lives and influences of woman, minority groups, and people at all socio-economic levels and from all cultures and not focus so exclusively on the histories of those with political, social or economic power.

Recommendation 14: The theoretical base established by Olesen's (1987) framework for social studies should be considered as supportive of critical and creative thinking.

Recommendation 15: Curricular revision in the natural and physical sciences should include the epistemological understanding of what would constitute accurate portrayal of the methods of science and of its relationship to the social, political, economic and technical realities of the time in question.

> 15a: This revision should include exploration of values, responsibilities and influences reflected or implicated in scientific research including ways to explore the concept of risk as it applies to scientific and technological research and to the role of the experts in our society.

Recommendation 16: Curriculum developers should do as much as possible to encourage the more active participation of female students through the inclusion of a wider range of analogies and biographical material on women in sciences.

Recommendation 17: Curriculum development in the sciences should make use of the "Summary of Framework for Science Curriculum" (Hart, 1987) as a model which incorporates an epistemological emphasis and integration of critical and creative thinking processes.

Recommendation 18: Saskatchewan Education must take a leading role in the development of a policy on the selection, training and evaluation of educational administrators. Such a policy must incorporate understanding of the importance of emancipatory critical thinking to educational leadership.

Recommendation 19: The educational leadership program developed by the Department of Educational Administration, University of Saskatchewan should include a compulsory half-class in critical thinking and its implications for educational leadership.

Recommendation 20: Curriculum and course revision must be undertaken by Colleges of Education in order to provide teachers and education students with understanding of the contents and methods of critical pedagogy and creative processes and their evaluation.

Recommendation 21: The Internship Supervision Manual should be revised to incorporate a broader vision of pedagogy than is now the case-including practices more supportive of critical and creative thinking than predominately teacher-directed methods. This revision could be the joint responsibilities of the Saskatchewan Teachers Federation and the two Colleges of Education.

Recommendation 22: The Saskatchewan Teachers Federation needs to take the leadership in developing a new policy and guidelines for teacher supervision in line with the critical and creative thinking practices being recommended here together with those from the incorporation of the other Common Essential Learnings.

# CHAPTER ONE: INTRODUCTION

> "Thinking - how should I define it? It is a soundless dialogue, it is the weaving of patterns, it is a search for meaning. The activity of thought contributes to and shapes all that is specifically human. In building upon past knowledge, men and women transform the known - and the culturally transmitted means of knowledge - into new discoveries and into the ever changing forms of thought and language." (John-Steiner, p. 210) 1985

The most difficult task in achieving a rationally justifiable position regarding the place of critical thinking and creativity in any education system is to define adequately what is meant by these two terms. Both suffer from a degree of vagueness and a variety of conflicting perspectives which make agreement on terms difficult. One is perhaps best served by considering them as concepts evolving in a process of continuous development and refinement by educational practioners, researchers, philosophers and learning theorists. The most adequate definitions for our purposes must recognize this range of meanings and adopt those which best serve the present goals for Saskatchewan education. This must be done, however, without limiting the potential of creative and critical thinking to reflect upon these same goals and to create if necessary, broader, more rational and more ethical versions of what education should accomplish. Perhaps no other curricular task demands necessarily so much freedom from limiting perspectives as the inclusion of creativity and critical thinking in learning across subjects and grades. It is important to be clear about why this is so. Critical and creative thinking, when employed fully, involve people in understanding and working with the contradictions and complexities of all aspects of life. Therefore, no subject matter or method should be ruled out (from the beginning) as outside these thinking processes. What can be eliminated from critical and creative thought is the dogmatic stance.

Definition of critical and creative thinking involves coming to grips with several related epistemological issues and an understanding of epistemology is central to all that follows. One cannot, therefore, proceed without stressing the importance to understanding critical and creative thought of comprehending what is meant by epistemology. Whenever one tries to understand how historians establish historical "facts" or how scientists build their theories about the world from research and experimentation, one is doing epistemology. Whenever a child reflects upon the existence of Santa Claus, bringing in evidence for and against, or an adult attempts to clarify why they do not believe the official Soviet version of their reasons for invading Afghanistan, epistemological thinking is taking place. Epistemology has to do with the origins, nature, methods, and limits of knowledge, - with how one can know and how one could be certain of the truth of any claim. Reflections upon the evidence or grounds for beliefs which have become accepted knowledge or are candidates for such knowledge in the sciences, humanities, and arts is fundamental to critical and creative thought.

Epistemological issues which need clarifying in this paper include understanding: the extent to which theoretical constructs such as "creativity" and "critical thinking" resist identification and isolation as actual phenomena; the effect which different purposes for including creative and critical thinking as common essential learnings have upon how these terms come to be defined; how different methods of teaching or developing the skills, attitudes and processes of creative and critical thinking are implied in different definitions; the potential for creative and critical thinking to lead to questioning of the accepted, the taken-for-granted, the "valued but unquestioned", including current social and economic structures and cultural and religious belief systems; and, the extent to which a society's perspectives of the 'useful' and the 'aesthetic' may limit the possibilities for creative and critical thinking in any school system. Finally, definition of creative and critical thinking requires some explication of whether and in what ways they differ and/or coincide as processes of thought. Given the above qualifications, this paper's definitions of creativity, critical thinking and other related terms will be stipulative definitions (that is, definitions developed for a particular set of purposes) and should not be seen as complete or final definitions in any sense.

Should all of the former philosophical issues be adequately dealt with we are still left with the practical and technical problems of:

1. Which skills, attitudes and processes of creative and critical thinking are both possible and appropriate to teach at the various grade levels?
2. What methods best facilitate growth in creative and critical thinking? This question includes deciding wisely upon whether to imbed creative and critical thinking into the various subject areas, to teach them as isolated techniques or a combination of these approaches.
3. How do we fit these methods and the content which accompanies them into already crowded curricula and timetables?
4. Must teachers be creative and critical thinkers themselves in order to develop creative and critical thinking in their students? What types of information and in-service might teachers need?
5. How do we evaluate critical and creative thinking?

This paper will include discussion of all the above issues and concerns. Before critical and creative thinking are examined separately in the next two sections, some general comments about their similarities and differences will be made. In order to examine creativity and criticalness as types of thinking, a general view of thinking or intelligence must be established. This view must be established within a broader framework which outlines what is meant by education.

## Relating a view of education to a view of intelligence

While one way to understand what is intended (in Saskatchewan) by the concept of education is to examine the Goals of Education In Saskatchewan (1984). a more universal reference point must also be established in order to examine the adequacy of these goals or of the concept of education being put forth. Before evaluating the conception of education in any particular context one must have a standard for comparison. Analyses such as Stewart's (1986) examination of the ends and means of schooling or McPeck's (1981) discussion of the minimal criteria for education have produced such a standard.

Both see education and reason as inextricably linked. Stewart says that an educated person "is one who sees the reasons why of things, is generally able to respond to the world intelligently and is capable of informed, rational choice and critical judgement" (p. 4). McPeck establishes the necessary connection between reason and education in the following steps: 1) even a minimal definition of education entails the acquisition of knowledge, 2) one must have a justification for one's belief in order to distinguish knowledge from mere true opinion, and, 3) such justifications require reasoning. Both analyses also emphasize the interrelationship of cognition and affect. They stress that development of rational capacity is related to the development of social and moral virtues and the development of emotions. The importance of this interpendence of cognitive and affective factors of mind to understanding the nature of creative and critical thinking will be stressed throughout the paper which follows.

## Intelligence as power, tactics, content and will

> "Into every act of knowing there enters a passionate contribution of the person knowing what is being known....this coefficient is no mere imperfection but a vital component of his knowledge." (p. viii) (Polanyi, M. 1958)

Perkins (1986) has established a perspective on intelligence which confronts and resolves some of the controversy surrounding its definition. He outlines three contemporary views of intelligence and proposes a synthesis which incorporates all three views. (While the views are not mutually exclusive, Perkins emphasizes how they contrast in order to better establish his point.)

One widely held perspective sees intelligence as "power" - a theory that intelligence depends on the neurological efficiency of the brain as an information processing device. "Most investigators with a power view of intelligence hold that learning does not affect this power very much, although nutrition and mental stimulation over a period of many years may have some impact (p.5)."

Another contemporary view sees intelligence as largely a matter of tactical repertoire or the availability of techniques for thinking. This theory leads to identification of learning strategies and processes with the potential to improve intellectual functioning.

A third perspective emphasizes that intelligence depends principally on a rich knowledge base in the domain in question: effective thinking in any area is built upon mastery of content in that area. General strategic knowledge is considered of little use in increasing intelligent behavior.

Perkins argues that if our question is: "What is thinking made up of that it might be improved?" then our best perspective on intelligence is one that includes all three of the above perspectives. Intelligence, then is equated with a combination of power, tactics and content. While the state of current learning theory does not suggest any immediate way to develop further the power aspect of intelligence, tactics and content aspects are considered amenable to improvement through instruction.

While Perkins' construction is useful in highlighting some of the necessary components of intelligence it is not a sufficient analysis. Particularly it is not a sufficient perspective on his question of "What is thinking made up of that it might be improved?"

Implicit in the work of many theorists examining critical and creative thinking is a view that such thinking is also highly dependent upon disposition to think. That is to say that someone might have the power, tactics and content necessary to create or criticize a particular product but fail to do so due to a lack of desire. One could ask: Is it intelligent behavior to *not* use whatever intelligence is available to you? Or, how can we know the limits of our own intellectual power, tactics and content without consciously and constantly employing and seeking to improve them? Any analysis of intelligence which leaves out the contribution of "will" leaves out a lot.

My use of the word "will" is intended to include the concept of motivation but to be somewhat broader and deeper in application than "motivation" as it is commonly used in curriculum theory or educational psychology. While "to motivate" is to provide with a motive, such provision does not necessarily lead to action. "Will", however, includes a strong relationship between purpose, desire and action and it is this strength or determination which is being implied here in relation to reason. Will is being used to stand for the power of self direction, for strong purpose and determination and for conscious and deliberate action or choice. Discussing intelligence without reference to the place of the human will is like discussing moral behavior without reference to consciousness.

When we think about what "intelligent" means we are forced to say also something of what it means to be human. Our humanness involves us in the conscious employment of reason and thus in responsibility for the choices which our lives represent. Creative and critical thinking can be examined and differentiated in relation to these choices and our responsibility for them.

### Creativity and criticalness as interdependent types of thinking

Creative and critical thought can be defined most generally as the former involving the development or creation of objects, processes, experiences or thoughts and the latter as the evaluation of the same. Further separation of these thought processes is both difficult and inconsistent with this paper's view of their importance to education. Their importance lies in their *mutual* employment. Critical thinking which is uncreative can make judgments but cannot generate alternatives to a negative judgement and uncritical creative thinking can give as much weight to an unethical alternative as to an ethical one. When Emig (1983) describes the importance of the imagination as being a vehicle for the creation of "alternative social, economic, and sexual structures and arrangements" (p. 177) she is also making a claim for the *critical* employment of the imagination and for the *will* to create alternatives to what she calls the "bankrupt" structures and arrangements now in place.

Ultimate justification for the mutual development of critical and creative thought is that such development supports the survival and regeneration of societies and eco-systems. Accountability to future generations is inherent in this mutuality.

Further arguments for their interdependence can be established through conceptual analyses such as that provided by Bailin (1986) who views creativity as good thinking in general and stresses that such thinking involves learning the skills, principles and problems of any discipline being focused upon and the attitude of discriminating receptivity. John-Steiner's (1985) research on the thought processes of creative scientists, philosophers, writers and artists reveals the idiosyncratic nature of creative thought, the critical attitude which such thinkers maintain towards their own work and the central position of human will in their achievements. Frameworks such as Bailin's and John-Steiner's show the necessity for an interplay between creation and evaluation. John-Steiner's stresses additionally the importance of self direction and purpose to sustaining creative and critical thought.

In reviewing the position which sees a necessary relationship between development of critical and of creative thought the following points have been made. Education has been associated with acquisition of knowledge and development of an intelligent response to the world. Reasoning is crucial to the achievement of both and is dependent upon the interplay of cognition and affect. This is so particularly because the acquisition of knowledge is not seen merely as an end in itself but as part of our commitment to the future of the world. As Bronowski wrote in The Ascent of Man, "above all, it [knowledge] is a responsibility for the integrity of what we are, primarily of what we are as ethical creatures" (p. 438) Such a responsibility involves the concomitant use of creative and critical thought.

### The centrality of meaning

Koestler suggested in The Ghost in the Machine that when cognitive science has probed into every area of the human brain the mystery of the source and depth of the human will would still remain. Questions like "What inspires and sustains thoughtfulness and critical reflection?" and "What makes (or could make) thinking continuous, conscious, accurate and ever more refined?" require answers from inside human experience. Self reflection, participation in dialogue about thinking, and the study of works from literature and philosophy provide ways of answering such questions that seem closer to what educators need to know than those which remain at the level grasped by "objective" or "empirical" methods alone. The argument which follows is based upon a synthesis of such reflection, dialogue and reading over a number of years. Thus credit for the original sources of these ideas can not be given.

What is the relationship of "meaning", as import, sense, or significance, to the human will to know? One answer is contained in the paragraphs which follow.

Whether curiosity is initially aroused by an observation of the physical or the social world, further questioning and investigation focus upon relationships between parts and wholes, between object and object, between object and event, etc. Once an initial perception is made, curiosity acts in such a way as to move us out from that perception in any or all directions. Human thought works through the making of connections and relationships and thus is driven by a belief in their importance and in the usefulness of further questioning. How does one achieve and sustain such a belief?

The desire to know comes from viewing the world as meaningful in some way. The effect of perceiving the world (including the inner world of self) as devoid of meaning, as totally unpatterned, random and arbitrary would be the cessation of questioning. One cannot grasp randomness in any way that moves forward or beyond that initial perception. To believe that nothing in the world has permanence, meaning, sequence or substance is to know everything that could be known under such conditions. Thus the initial perception of some meaning or pattern to life is the one necessary for birth of the desire to know and always forms part of the motivation to seek further knowledge. Many experiences of stability in physical objects or patterning in social events provide the young child with that initial perception of meaning. What is important to understand, however, is how the search for meaning is sustained in the school years as experiences and perceptions accumulate and often contradict or deny our original formulations of their sense.

The role being assigned to critical and creative thinking is that of a vehicle for supporting understanding of the past and present and the creation of a better future. This purpose necessitates thinking which not only sees the relationships between objects and events in the physical world or between people and events in the social world but between the physical and social worlds themselves. Put most simply, this requires that students in classrooms learn to ask of each new piece of knowledge, theory or insight, - What has this to do with me? With other knowledge I possess? With the global community? While all of these questions will not be applicable in all situations, even children in the early grades have acquired a body of knowledge against which new knowledge can be tested or relationships applied. Such questioning is not only congruent with the purposes for critical and creative thinking set out above but also supports that sustained creation of meaning necessary for the growth of the reflective individual.

Some general principles for education which reflect this focus are:

1. Personal experience must not be fragmented by a school reality which mirrors the interests and experiences of only a portion of our society while neglecting those of others, or by a lack of depth or breadth of curricular materials. Students must find some evidence or acknowledgement at school that the realities which they experience at home or with their friends exist as realities while being offered other versions of human life.
2. School subjects must not be studied separately from world events and issues but rather as frameworks for understanding them. Such relationships must be made an explicit part of each discipline through daily incorporation of individual, community or global issues and concerns into the knowledge being constructed at school.

3. School subjects must not be studied in total isolation from each other. The lessons from history, literature or economics should inform study in chemistry, physics or biology in ways similar to how knowledge in these areas first developed, that is through the questioning and insights of individuals with their own interests, histories and cultures.
4. Students should be encouraged to see knowledge as the product of human minds - as dynamic, and constantly refined - and not as inert subject matter which always existed. Incorporation of biographical and autobiographical material into science, social studies, mathematics, art, etc. (where such material is available) on individuals who contributed to the school knowledge being examined, is recommended.
5. Meaning is created through recognition of one's relationship to the knowledge being presented, through establishing relationships between knowledge from separate fields and through seeing a point to knowing more.

We seek clarity when we believe clarity is useful and possible. This means holding a two-fold view of the centrality of meaning: on the one hand we must perceive some order in the universe as a starting point for further reflection, on the other we must think that what order we perceive or create matters (i.e. that the order or patterns perceived must reflect real aspects of the universe, not the arbitrary decisions of a closed mind). Thus, thought is initiated by recognition of meaning and is sustained by the pursuit of meaning - by a drive to make sense of new observations and experiences. The pursuit of meaning is best supported by the progressive development of relationships between knowledge of the physical and social world and knowledge of the self.

Although the centrality of meaning in strengthening the human will to know can be established in this manner, the problem of how disparate abilities amongst individual students affects their will power, remains to be examined. While will is strengthened by purpose, it also appears dependent upon ability. The relationship between different views of intelligence and educational processes consistent with a focus upon the creation of meaning as central to critical and creative thinking will be the focus of the next section.

## A theory of multiple forms of intelligences and its implications for creative and critical thinking

Gardner (1985,1986) argues that how a society defines intelligent behaviour is highly dependent upon what that society values: only a view which sees intelligence as a complex of different abilities rather than as one general ability has any hope of achieving universality. This culturally-biased nature of intelligence which Gardner explicates helps make sense of a dominant view of our society - a perspective that sees the products of scientists whose work supports the growth of technologies, as being the result of intelligence while the products of artists are seen as resulting from creativity, as though it were some entity or process separate from intelligent behaviour.

One way around this dichotomy has been suggested as that of viewing creativity as simply one aspect or quality of good thinking. A framework which both incorporates critical and creative thought processes as interrelated types of thinking and eliminates most of the problem of cultural bias in intelligence assessment and theorizing is that of multiple forms of intelligence. In this theory people are viewed as having intelligence in unique combinations of seven different areas and as being especially capable of creative and critical thought in those areas in which they have the most "intelligence" in Perkin's sense of intelligence as power. This theory does not contradict the need for persons to also develop content and tactics in those areas of strength but rather proposes that that need will be best supported by human will in those areas where intelligence is strongest.

Justifications for a theory of multiple forms of intelligence come from brain research, cross-cultural studies of intelligence, studies of creative individuals, attempts to resolve the paradoxes created by the results of studies in education which focus upon I.Q., achievement and cultural difference, philosophical development of multiple symbol systems such as that established by the Cassirer-Langer-Goodman traditions, and from the need for a more reflective, less rigid view of human potential which would support the diverse abilities needed to create alternatives to our present sexual, social, political and economic structures.

Gardner and Walters (1985) discuss multiple forms of intelligence in light of criteria for their establishment, characteristics of each intelligence, and the educational implications of such a theory. Their criteria for the isolation of a specific intelligence include that it must be demonstrated as: 1) an ability to solve problems or fashion products that are of consequence in a particular cultural setting; 2) an identifiable core operation or set of operations; and, 3) its susceptibility to encoding in a symbol system. The seven forms of intelligence identified by Gardner, Walters and others are musical, bodily-kinesthetic, logical-mathematical, linguistic, spatial, interpersonal, and intrapersonal intelligence. (See Appendix I for a description of each)

This theory has much to recommend it including that it is consistent with viewing creative and critical thinking as equally important aspects of reflection within any intelligence, discipline or art, and is more supportive of educational practices and emphases which do not contain cultural bias than is presently the case with practice based upon intelligence as "I.Q.". Its acceptance is also more likely to lead to the fuller development of all the abilities which our civilization needs to survive. In short, it is a useful theory within a paradigm which takes education as being ultimately a moral endeavour supportive of the continuance of life on this planet. Therefore. this theory is the final support in the framework within which more specific understandings of critical and creative thinking will be developed.

## Creative and critical thinking: Commercial programs and curriculum developments issues

An important concern to be addressed by educational systems that wish to stress critical and creative thinking is selecting the best format for content and delivery. A number of programs designed to foster thinking skills are available currently and their appropriateness and usefulness are natural foci for inquiry. Such commercial programs will be examined here using the standards arising from the theoretical development of the proceeding pages. Thus, we will not be asking simply "Are these programs any good?" but rather are they good according to the purposes for education and the theories about knowledge, learning and intelligence outlined above.

In order to understand the following critique of commercial programs designed to foster thinking skills one needs a theoretical base which establishes the important dimensions of learning and knowing. Knowledge can be considered static and transferable without involving necessarily any qualitative changes in the learner, or dynamic and actively constructed by humans in the act of knowing. The latter "constructivist" view of learning is one which sees thinking and feeling as interrelated and purpose and meaningfulness to the learner as crucial for genuine understanding and depth of knowledge. This is the view of knowledge acquisition most congruent with the theory base of this paper and with Saskatchewan's goals for education. It is a view which makes many demands for consistency upon curricular content and pedagogy. These demands include adopting an integrative rather than an isolating view of thinking, a call for thinking skills to be developed as inherent aspects of acquiring school subject matter rather than as entities which stand on their own. Further consistency comes from the integration of values and attitudes with the learning of skills, processes and concepts. Commercially developed thinking programs have (of necessity) been developed in isolation from school subject matter and knowledge of the interests, purposes and concerns of the learners for which they are intended. For the most part, they reflect a stance of generalizability across areas of subject matter and contexts of learners. This type of curriculum development can be characterised as technical as opposed to the integrative and critical approach being recommended here. Table 1 shows the assumption underlying these two approaches, assumptions which are central to the question of whether creative and critical thinking can be taught as technical skills.

TABLE I

ASSUMPTIONS UNDERLYING CONTRASTING APPROACHES TO CURRICULUM DEVELOPMENT RELATED TO CRITICAL AND CREATIVE THINKING

| TECHNICAL SKILLS APPROACH | INTEGRATED CRITICAL APPROACH |
|---|---|
| 1. Assumes critical and creative thinking are skills which can be learned without necessarily holding to their underlying values and attitudes. | 1. Assumes critical and creative thinking are processes which can be learned only through concomitantly learning the attitudes and values which they contain and which interact continuously with the "skills" aspect of these same processes. |
| 2. Assumes creative and critical thinking are skills which can be taught in isolation from the subject matter of school curriculi and later applied to to them and to all aspects of life where such skills might be useful. | 2a. Does not assume that transfer of critical and creative thinking skills can be predicted on any basis other than that which includes adhering to their underlying values and attitudes. (Will and the desire to think critically and creatively are necessary for continued use of their skills and processes.) |

TABLE I CONT'D

| | |
|---|---|
| | 2b. Assumes that because one must have some content to focus upon during any act of thinking, it is both logical and practical to use the subject matter of school curriculi as the content for learning the process of thinking. |
| 3. Assumes one can estimate the level of difficulty of particular thinking skills and developmentally sequence them accordingly. | 3. Assumes that skills considered in isolation have no intrinsic level of difficulty. Skills are easy or difficult only in the context of the process in which they are used, the subject matter of interest, and the level of sophistication of the learner's thinking. (The same skill such as observation could be more abstract and complex for a 15 year old than for a four year.) |
| 4. Assumes that thinking skills can be analyzed into their component parts, sequenced into steps, the sequence taught and utilized accordingly. | 4. Assumes that humans do not necessarily process information in a step-wise fashion or isolate one step at a time; and that how one is taught a skill is not necessarily how it will be processed or used. |
| 5. Assumes that the important question to be asked is can creative and critical thinking be taught as skills. | 5. Assumes the important question to be asked is should creative and critical thinking be taught as skills. |

While a comparison such as that presented in Table I may be distorted somewhat in the attempt to highlight differences, it can be a useful tool for clarifying the issues surrounding the adoption of packaged thinking programs. Table I addresses the assumptions surrounding whether or not critical and creative thinking can be taught as technical skills. One should be clear as well about the implications arising from acting upon either set of assumptions.

As the position advocated in this paper is that of adopting an integrated critical approach to creative and critical thinking, the prior question to be addressed is, (given that one could) should one teach critical and creative thinking as skills? The greatest danger in technical approaches to curriculum development of all kinds is the loss of meaning and purposefulness to learning which results. In a society where espoused values and lived values are already separated to a great extent and where truth and politics are kept for the most part in separate compartments, our students receive enough messages that cannot be absorbed into the total fabrics of their lives. One wonders if in many cases today "whole" students are being created or destroyed. It becomes easier and easier to not apply school learnings to one's personal life when application and integration are not habitual moral behaviors of one's culture. Violence in sports is not related to the same moral principles as violence in the streets and the crimes of the rich or powerful are not necessarily related to the same moral principles as the crimes of the poor. Recreation is in one compartment with one set of rules, making a living in other, while morality may well be in a third or forth compartment and not related in any consistent way to any other aspect of life. Technical approaches can leave us comfortably fragmented as moral individuals. They tend to create reliant and passive learners who have not achieved the habit of integrating learning and constructing knowledge for their own purposes. However, one who thinks critically and creatively in the emancipatory sense will be bound by this complex of processes, values and abilities to use their knowledge to critique life as a whole and to find uses for technical learnings which can be woven into a moral existence.

A more specific examination of the many "thinking" programs available is, of course, possible. What is being argued here is that given the above position, it is not necessary to analyze them further than on dimensions consistent with

Saskatchewan's goals for education and the theoretical base of this paper. These dimensions can be summarized as: 1) integration of technical skills with the values and attitudes underlying critical emancipatory thought; 2) inclusion of the questioning, speaking and writing processes which foster dialectical reasoning(See Chapter 2 for a further examination of this criterion); and, 3) integration of thinking skills, values and processes with school subject matter and the needs, interests and experiences of the learner.

The ideal situation would be one where school subject matter, real-life issues, the processes of critical and creative thought and their underlying values and attitudes are integrated into curriculum guides in each of the subject areas. As Sternberg (in Costa, A.L., 1985) reminds us, a program for improving reasoning

> ...should be socioculturally appropriate. It should be clear from the examples described here that programs differ widely in terms of the student population to whom they are targeted. The best intentions in such a program may be thwarted if the students cannot relate the program both to their cognitive structures and to the world in which they live. (p. 185)

While these criteria have implications for teacher training as well as for curriculum development, it is the latter we are concerned with here. The context of usefulness for commercial thinking programs which this paper proposes is that they be considered as sources of process activities for integration with subject matter in provincial curriculum guides. Table II lists some common programs and notes the dimensions on which they might offer some guidance to curriculum developers. It should be noted, however, that this is intended as a starting point only. More detailed analysis of the processes and skills contained in current programs is available in Part VIII of Developing Minds, Costa, A.L. (Ed.), 1985 and in Thinking in the Classroom: A Survey of Programs, Chance, P. (1986). See also Appendix III for a brief description of some common programs including the extent to which specialized teacher training is felt by developers to be necessary for their use.

TABLE 2

COMPARISON OF COMMERCIAL THINKING SKILLS' PROGRAMS
ON THREE CRITICAL DIMENSIONS

| Name of Program | Involves Students in Consistent Integration of Values & Attitudes Underlying Critical & Creative Thinking with their "Skills" Learning | Contains a Focus on School Subject Matter or on Application to School Subject Matter and Real-Life Issues | Contains potential for Involving Students in Dialectical Reasoning |
|---|---|---|---|
| **Instrumental Enrichment** | | | X |
| **Odyssey** | | | X |
| **Philosophy for Children** | X | | X |
| **Productive Thinking** | | | |
| **CORT** | | | |
| **Basics** | | X | |
| **Learning to Learn** | | X | |
| **Creative Problem Solving** | Partially (Emphasis on creative as opposed to critical values) | X | |
| **Guided Design** | | X | |

TABLE 2 CONT'd

| | | | |
|---|---|---|---|
| Project Impact | | X<br>(L.A. & Math) | X |
| Strategic Reasoning | | X | |
| SOI | | X | |
| Future Problem Solving | | | |

The chapter which follows will examine issues and concepts in critical and in creative thinking separately while the final chapter will discuss their interrelated features which have implications for curriculum development, evaluation, educational leadership and teacher training.

## CHAPTER TWO: CRITICAL THINKING AND EDUCATION

A very general stipulation of critical thinking as the evaluation of objects, processes, experiences, concepts, statements, arguments, laws, principles, hypotheses, theories and world views will provide a starting point for its further refinement. One of the ways to understand the particular nature of critical thinking is to explicate what it is not, i.e., to understand what it excludes.

Both D'Angelo (1971) and McPeck (1981) caution against applying the term critical thinking too widely. McPeck argues that while critical thinking is one form of thinking, a form which involves the appropriate use of reflective skepticism, - all skepticism is not appropriate. In critical thinking one learns when to question something and what sorts of questions to ask. Questioning in itself is not necessarily a critical act.

### The "Yes it's teachable" assumption

From the sheer volume of what has been written about the teaching of critical thinking one might assume that it exists and is teachable. Such assumptions can be unfounded, however. This paper, therefore, establishes the instructional value of teaching for critical thinking through: building on the analysis of Perkins (1986) in arguing that content and tactics are amenable to instruction; the focus on will as shaped by personal meaning; and Paul's (1985) assertion that criticalness exists as a matter of degree, - no one who thinks is totally devoid of critical thinking capacities. To the extent which critical thought exists as potential we may safely assume that it can be enhanced, increased, further integrated into one's life or left idle. Hullfish and Smith (1961) cite the authority of their years of classroom experience in developing reflective thought to argue that motivation or purpose is the key to unlocking human critical capacities.

Another answer to the question of whether critical thinking is an ability which responds positively to teaching is to examine the extent to which this ability can be dulled, diminished or restricted. In highlighting a couple of aspects of how this capacity may be limited by individual dispositions, John-Steiner (1985) comments:

> Human beings are characterized by a great plasticity of body and mind; however, this plasticity can be narrowed by habit and by the fears of the unknown. (p.1)

Paul (1985) in discussing barriers to critical thought suggests that childhood ego-identification with adult beliefs is a potential vehicle for closed-mindedness. While Paul's point is valid in that children are shaped by their parents' views, such identification with adult values and beliefs could work to promote as well as deter critical thought depending on the nature of those values and beliefs.

Paul also discusses human selfishness as an obstacle to critical thinking which acts upon our thinking in ways that "maintain self-serving or pleasant illusions "and" rule out or unfairly undermine opposing ideas (p.152)".

Norman Goble, Secretary-General of the WCOTP in an address to the "Directions" Conference held in Saskatoon in October of 1985, identifies a more social, political and global phenomena which acts to restrict critical thinking, -- the power of vested interests.

> The educational effort has always been subject to distorting pressures, to attempts at subversions and deformation by those whose main concern was to protect or promote a particular distribution of power in society. Special interests try to make it the vehicle of specific ideologies or an instrument of domination and exploitation.

When critical thinking is seen as a human capacity jeopardized by repressive conditions, it is not difficult to make the leap to asking what conditions enhance it or to an understanding of its justification as a vehicle to qualitatively improve education systems in democratic countries.

Justification for a focus upon critical thinking in schools

Critical thinking has been exemplified in educational literature as a positive educational end in itself and as a means to further ends, - as an essential ingredient in developing personal autonomy and greater social justice. Hitchcock (1983) argues that the most fundamental ground for developing our ability to reason is that man is first and foremost a reasoning animal. "In a certain sense to be a good human being is to be good at reasoning, to have good critical skills". (p.7) Drake (1976), among others, sees critical thinking as an on-going and necessary ability for making sense of all that transpires in the classroom. It is one of the abilities frequently cited as part of the process of "learning to learn" or independent learning (Dirkes, 1981, Harnadek, 1980, Hitchcock, 1983).

McTighe and Schollenbergurs' (1985) views reflect a common argument when they claim that

> ...., the fundamental requirements of our democratic society provide a powerful rationale for focussing upon thinking. Democracy, as envisioned by our nation's founders, rests on an informed and intellectually able citizenry. (p.5)

One of the strongest statements of the necessity for actively encouraging critical thinking through its inclusion in school programming comes from Richard Paul (1985). He conceives of critical thinking as dialectical reasoning and a vehicle for human and social emancipation. He contrasts the procedural nature of technical reason with the ability "to reason across, between, and beyond the neatly marshalled data of any given technical domain." (p. 157) Paul says that the latter, when "used as a means of penetrating and assessing the logic of our mundane lives, alone creates the possibility of becoming intellectually, emotionally and morally autonomous persons". (p. 157)

Given the arguments above together with the Goals for Education in Saskatchewan (1984) which also emphasize individual responsibility, autonomy and the importance of working to create greater social justice, it is not difficult to justify a strong and inclusive definition of critical thinking for Saskatchewan education. Clearly, a perspective on critical thinking as merely a technical skill would be inadequate.

Paul (1985) emphasizes the importance of recognizing a fundamental difference between two distinct conceptions of critical thinking, a conception of critical thinking as a product of mastering a discrete set of skills and one of critical thinking as emancipatory reason. It is the latter conception which is being recommended here. While Paul describes emancipatory reason as a "set of integrated macro-logical skills ultimately intrinsic to the character of the person" (p. 152), it might be better described as the integration of skills, abilities, attitudes and values. When critical thinking is considered as essential to the free, rational and autonomous mind - then the understanding that it includes insight into one's own thought processes, attitudes and motives is essential. Such insight forms an important part of understanding the values, attitudes and theories which underlie the thinking of others.

## The necessary and sufficient conditions of critical thinking as emancipatory reason

In order to establish an adequate conception of critical thinking in the sense outlined above, several questions need to be answered. These include:

What values underlie critical thinking?

What dispositions or attitudes are necessary?

Which thought processes and procedures support critical thinking?

What content can critical thinking focus upon?

Values and attitudes. Critical thinking is based upon a sense that the values of truth, fairness, justice, empathy, autonomy, rationality and self-criticism are of crucial importance to participation in social life. Further, emancipatory critical thought is based upon the belief that holding such values implicates one to act upon them.

Attitudes or mental postures important for the development and practice of critical thinking can also be identified. While, D'Angelo (1971) identifies ten attitudes as contributing to critical reflection, some overlap exists amongst some attitudes in his list. Others appear overly simplified. Therefore, D'Angelo's original set of attitudes have been modified somewhat below.

1. Intellectual Curiosity. Seeking answers to various kinds of questions and problems. Investigating the causes and explanations of events; asking why, how, who, what, when, where.
2. Objectivity. Being objective in the process of making decisions. Relying on empirical evidence and valid arguments, and not being influenced by emotive and subjective factors in reaching conclusions. (Objectivity can be confused with neutrality, however. It is necessary that one not be neutral to freedom over tyranny, for example.)
3. Open-Mindedness. Willingness and ability to change one's beliefs or methods of inquiry when warranted by new evidence, counter-argument or a lack of progress using present methods. Avoiding the dogmatic attitude and rigidity.
4. Intellectual Honesty. Acceptance of statements as being true when there is sufficient evidence, even though it goes against some of our cherished beliefs. Not slanting facts to support a particular position.
5. Being Systematic. Following a line of reasoning consistently to a

particular conclusion. Avoiding irrelevancies that stray from the issue being argued.

6. Persistence. Being persistent in seeking ways of resolving disputes. Supporting certain points of view without giving up the task of finding evidence and arguments.
7. Respect for Other Viewpoints. Willingness to admit that you may be wrong and that others' ideas may be correct. Listening carefully to another point of view and responding accurately to what has been said.

While these attitudes may be considered as important to sustained critical awareness, it should also be noted that one can think critically without displaying all of them all of the time and that they are not natural attitudes common to all humans. Such attitudes and the values which underlie them can be both difficult to acquire and to maintain. An examination of barriers to critical thought would be helpful in revealing some of the sources of this difficulty.

Barriers to critical thinking. Social philosophers such as Habermas (1971,1984) and Gadamer (1982) have analyzed extensively the nature of truth, knowledge and the human processes which lead to these and argue that one cannot learn that which one does not really want to know. Central to their argument would be an observation like the following: We all wear blinders to truth in some areas of reality, those areas where questioning may reveal truths that shake the carefully-laid foundations of our social world and our place in it, that implicate us morally in ways we would rather not be implicated.

An important foundation for developing attitudes such as those listed above is contained in our trust in ourselves and in others to be capable of growth and development towards the ideals of critical thinking. When we do not believe that change is possible, apathy or cynicism overshadow the critical attitude. We could also note that the more that is at stake for us personally in a critical debate resulting in one particular outcome, the less likely we are to be critical. The potential for loss of money, love or power (to mention only a few of the more obvious motives) acts to negate searches for the truth of a situation and to support critical thought being employed to convince others of our position regardless of its ultimate truth or fairness.

In a school system, this same tendency of humans to protect their own interests (or what they perceive as their best interests) is in effect. If a school system intends to place a greater emphasis upon critical (or creative) thought, educational administrators, trustees, teachers and students need reminding of the fragility of egos and the human tendency to identify emotionally with one's thoughts. They also need an awareness of the economic and political relationships a school has with the outside world and of certain individuals' or groups' need for power and control.

Within the school environment some practices, if over-used, also act as barriers to critical thought. These include an overemphasis on content coverage and performance on standardized tests and on the thinking skills of recall or rote, habit as legitimation for practice, perceptions of limited availability of time and need for immediate solutions, fear of criticism and failure, lack of courage, and complacency. Finally, it must be noted that lack of knowledge and information in any area which is the focus of critical reflection is perhaps a greater barrier than any of the above. All that has been said about the barriers to critical reflection should remind us both that is difficult to achieve and that it is a worthwhile pursuit.

Processes and procedures which support critical thinking. Great inconsistencies exist (in the literature on critical thinking in education) as to the degree to which specific critical thinking procedures can be considered as technical skills amenable to instruction through demonstration and rote or the degree to which they are procedures which interact continuously with self knowledge and accompanying human emotions. The latter position would mean that the learning of critical thinking processes is not strictly procedural learning and that it is always predicated to some extent upon the attitudes and values discussed above. Our position follows that of Malikail and Stewart (1986) in feeling reluctant to use the word "skills" in a discussion of critical thinking procedures because its common usage emphasizes the behavioral component of competence over those of understanding, judgement and disposition (See p. 9 of Personal & Social Skills and Values for a more complete development of this argument). "Processes" will be used in this section to denote the dynamic and interactive qualities of critical thinking procedures as they are translated from text books to real life.

Perhaps the process most commonly prescribed for the development of critical thinking ability is that of mastering the procedures of logic. Agreement on what would constitute a sufficient focus for a course in logic, either for teachers or for students, however, is not fully settled. The range of logical aspects of critical thinking has been described in the literature by Ennis and others. (See Table 3 for Ennis's twelve aspects of critical thinking as set out by Drake 1976, (p.34)

TABLE 3

| OBJECT OF JUDGEMENT | ASPECT OF CRITICAL THINKING |
|---|---|
| 1. STATEMENTS | Grasping the meaning of the statement<br>Judging whether certain statements contradict each other<br>Judging whether a statement is specific enough, i.e. free of vagueness, ambiguity |

TABLE 3 CONT'D

| | |
|---|---|
| | Judging whether an observation statement is reliable<br>Judging whether a statement made by an alleged authority is reliable |
| 2. LAWS, PRINCIPLES, and HYPOTHESIS | Judging whether a principle establishes a statement alleged to be an application of it<br>Judging whether an inductive conclusion is warranted |
| 3. ARGUMENTS | Judging whether there is ambiguity in a line of reasoning<br>Judging whether a conclusion follows necessarily<br>Judging whether an inductive conclusion is warranted<br>Judging whether something is an assumption |
| 4. TERMS | Judging whether a definition is adequate |
| 5. PROBLEMS | Judging whether the problem has been identified |

While this table includes more than judgement of arguments, most theorists agree that the logical dimension is an evaluative dimension which includes, most basically, the assessment of arguments. Dashwood - Jones (1976) defines argument as "the process of drawing someone's attention to a series of intellectual positions such that each position becomes a reason for accepting what is to follow (p.3)." However, as Paul (1985) amongst others, reminds us argument in the real world is seldom a series of intellectual positions. It is more likely to be a mixture of facts, beliefs, values and biases with both rational and irrational aspects adopted by people with all degrees of reflective skepticism ranging from open-mindedness to total blindness to the basis or motives for their holding to a certain position. Further, arguments in the real world most often involve a mixture of knowledge from several subject areas or disciplines. Clearly, the unravelling of such arguments involves more than pure logic. It seems more reasonable to recommend logic courses which develop argument assessment through the integration of logical, empirical and normative perspectives.

Agreement is fairly conclusive that the logical dimension of critical thinking has a strong linguistic base involving clarification of meaning through the definition of terms and the analysis of concepts. Much of this must be done discursively, securing mutual agreements as to how terms and concepts are being or should be used. This points to the necessity of including open discussion as an essential aspect of any course in logic intended to lead to "strong sense" critical thinking. This is equally true whether the students be in elementary school or in university. Paul (1985) argues that discussion leads to a greater likelihood that learning the skills and abilities of logic will continue to the level of application.

> Whenever possible students should be given every opportunity to advance ideas of their own and to give reasons to support them, as well as opportunities to hear the objections of other students. If this is done carefully in an atmosphere of cooperation and while learning critical analytic terms, students will begin to use critical distinctions when defending their ideas. This vocabulary integration sets in motion a very healthy process that, properly nurtured, can lead to at least primitive emancipatory thinking skills. (p. 154)

See Appendix II for an overview of the range of skills and abilities considered to be involved in the logical aspects of critical thinking. D'Angelo's 1971 summary was chosen because I consider it to be a typical and comprehensive reflection of what courses in logic developed by educational theorists focus upon.

McPeck (1981) considers critical thinking to also include the assessment of methods, strategies or techniques and of activities such as problem-solving which have identifiable intellectual components. While these elements are not included in Table 3, they are compatible with the expanded notion of critical thinking being recommended here. They should, therefore, be added to the content of logic courses designed specifically for educators.

The framework within which critical thinking has been defined here includes the interrelatedness of creative and critical thought. The creation of alternatives plays a large role in emancipatory critical thinking, in attempts to understand the other side of an issue or question or to imagine the reasons or motives of others. Thus, processes for critical thinking cannot be considered to be encompassed by the methods of logic. What more is involved might be better understood by looking to dialectical reasoning as an important process which builds upon the values, attitudes and procedures of logic referred to above. Before examining the nature of dialectical reasoning a brief look at the general thinking processes contained within in critical thinking might be useful.

Analysis of critical thinking in both a weak, or technical sense and in the stronger sense of critical emanicipatory reasoning includes the following thought processes: interpreting, clarifying, analyzing, synthesizing, evaluating, question-raising, information-seeking, reflecting on one's own thinking, assuming and raising and pursuing further questions. Following from this it should be obvious that the procedures and processes involved in research and study skills or independent learning would also be necessary. It is also important to clarify the content for critical thinking before examining the process of dialectual reasoning.

Possible content- necessary content. As was noted above in the discussion of logical analysis and its place in critical thinking. critical reasoning is not restricted to the assessment of arguments or of methods and strategies reconstructed as propositions. McPeck (1981 argues that:

> Doing things like solving problems and using methods often requires as much critical acumen as assessing statements within or about these activities. Decisions about whether to employ this strategy rather than, to modify a method in a certain way or even to disregard or change some standard technique are all grist to the critical thinkers mill, and it is grist that neither formal nor informal logic can grind, since logic is restricted to propositions. (p. 11)

While this analysis of critical thinking allows for reflection upon propositions, arguments, theories, world views and methods, procedures, experiences and activities, it does not reveal what knowledge might be necessary for such reflection. What has been suggested so far is that all of the above are possible candidates for critical thinking but that they become meaningful only when they are related to knowledge from a particular field.

The position being put forward is similar to that of McPeck's (1981), Cochrane's (1986) amongst others, who argue that critical thinking cannot be taught in the abstract. While the term critical thinking has an identifiable meaning, the criteria for its application vary from field to field because the evidence upon which knowledge is built differs in kind and method from field to field. For example, evidence in history cannot be built from direct manipulation of the variables considered to be important to a context in the past, while natural and physical scientists, working with models and concrete materials, rely heavily upon the manipulation of variables of interest for the establishment of supporting evidence. (See Hirst's (1974) Knowledge and the curriculum, for a detailed discussion of the ways in which different forms of knowledge require different truth tests.) What is being argued here is that critical reasoning involves combining the standards of logic with the criteria and procedures for truth within any particular field under scrutiny. Further, it is being suggested that to do this well, one needs a fair degree of familiarity with the methods and concepts of that field. Thus, knowledge of the field or fields where inquiry occurs is a necessary condition of critical thinking. This implies, for example, that while one might be able to think critically about literature, this does not guarantee that one will also be available to think critically in algebra. The necessary attitudes and values will hold across fields, as will some ability to apply the principles of logic, beyond this thought processes will need to be informed by the content and methods of the field.

Dialectical reasoning: putting it all together. If the ultimate aim of a focus on critical thinking is the development of reflective, autonomous individuals who are commited to protecting the autonomy of others (within the boundaries of democratic procedures and the social ethical principles accepted as universal human rights) then this education must include opportunities for growth in dialectical reason. Hofstadter (1974) describes the process of dialectical reasoning as both critical and creative.

> The essence of dialectical thinking is to find in each case what are the oppositions, conflicts, contrasts, contradictions, the otherness, estrangement, alienation that are possible in the content and to find the notion that unites them by incorporating and using rather than destroying their tension. (p. 116)

While this synthesis may be the ideal of dialectical reasoning, it is important to point out that it is not always (or often) achieved. It should be seen as an important part of the process however, in that, sustained dialectical reasoning is purposeful and its purpose is contained in the idea of synthesis.

Dialectical reasoning is called for whenever we wish to clarify technical, scientific, political, social or economic issues in the real world, -most "real world" issues being a mixture of the above. It is reasoning which involves us in logical analysis of knowledge from all fields touching upon the issue and of social and moral principles which appear (upon reflection) to be implicated in the analysis.

Paul (1985) contrasts the demands of dialectical reasoning and argument with that of reasoning in any technical domain and at the same time clarifies a linguistic point important to the understanding of emancipatory critical thinking. This is a crucial understanding. I will, therefore, quote Paul extensively here.

> .....Technical knowledge is typically developed by restriction to one frame of reference, to one standpoint. Knowledge arrived at dialectically, in contrast, is like the verdict, with supporting reasoning, of a jury. There are at least two points of view to entertain. It is not, as problem-solving theorists tend to characterize all problems, a movement from an initial state through a series of transformations (or operations) to a final (answering) state. .....Once into the ebb and flow of mundane life, into its messy criss-crossing of categories, values and points of view, its inevitable blending of the intellectual, the affective, and the moral, its embodying of irrationality in social practices and beliefs, there is little room for the neat and abstract procedures of technical reason. What is called for is dialogic, point-counterpoint, argument for and argument against, scrutiny of individual event against the background of this or that global "totalizing" of it into one's life. What is called for is liberating emancipatory reason, the ability to reason across, between, and beyond the neatly marshalled data of any given technical domain. Because it cannot presuppose or restrict itself to any one system or technical language or procedure, it must be dialectical. That is, it must move back and forth between opposing points of view. It must consider how this or that situation might be handled if we looked at it this way, or how if we look at it that way, of what follows from this construal and what from that, of what objection can be raised to this and what objection to that. It is the logic that is mocked in the typically closed minded exchanges of mundane human arguments about the personal and social affairs of life. it is the logic that is concept-generating as well as concept-using (since our point of view is shaped as we use it in a way parallel to case law).......
>
> Synthesis across or beyond technical categories can be used well or poorly justified. When outside the purely technical, part of the dues we must pay to justify rational confidence is empathy into the strongest case that can be made against our conclusion. (p. 156)

Paul distinguishes between technical language and natural language because this distinction is necessary for an understanding of dialectical reasoning. Failure to communicate well in any one technical domain may be due to a failure to grasp a technical concept which is inherently complex but not due to participants within the domain holding differing definitions of the concept. While some elementary students may have difficulty understanding the concept of "gravity", "gravity" within the domain of physics has one discernible meaning. This is not the case with many concepts involved in our natural, or across-domains, use of language. "Fairness", "creativity" or "normality" may be used very differently by different people or even by the same person in different circumstances. Dialectical reasoning involves, among other things, sorting out when our failure to understand the position of others results from a lack of knowledge in a particular domain and when it results from differing uses of the same concept. Familiarity with a concept may blind us to the fact that others are using it to stand for things different than what we intend it to stand for. For example, I may (due to a background in philosophy) use the word "argument" as referring to a series of reasoned positions while my colleagues at school think I mean a disagreement or heated discussion with no necessary connection to reason. This example shows how we may also remain unaware of the additional connotative meanings being attached to the word, either by ourself or others. This is another way of saying that while both knowledge of the technical domains involved in a position and knowledge of the principles of logic are necessary for dialectical reasoning, beyond this, self awareness and a fair degree of social and cultural awareness are also put to use.

Following from this, Paul points out that we must also know how to constantly shift our perspective from technical knowledge, to knowledge of logical or ethical principles, to self knowledge, etc. and to be aware that we are doing so. We must have insight not only into the grounds for our position but of those opposed to it if we wish to arrive at a rational and not a self-serving stance. Integration of all these aspects of critical thinking comes through engagement in the dialectical process. While the elements which go into this synthesis can be spelled out, explicit procedures for achieving synthesis cannot. Perhaps the best we can hope for in our development as critical thinkers is that the route will be more like a spiral than a circle.

### Critical Pedagogy

Before examining the classroom and all that might strengthen critical reflection within it, our vision should focus outward, beyond the teacher and her students to other influences which give a classroom its particular character. No one would argue the importance of the teacher's personal influence in shaping classroom atmosphere. Ordway Tead, in the first John Dewey Society Lecture (as quoted in Hullfish and Smith, 1961), reminds us to place this influence in its larger context if we are to truly understand its positive development and the limitations to that development.

> There is a point frequently neglected, however. Teachers are as dependent upon the quality of the situation within which they teach as are students upon the quality of the situation within which they learn. The atmosphere of schools (or, perhaps more suggestively, the climate of learning) is compounded of many factors, from community values to janitorial services. And a prime fact related to and conditioning all the others is the quality of administrative leadership. (p. 194)

This is as true today as when the words were first spoken. Directions (Saskatchewan Education, 1984) identifies educational leadership as an area targeted for improvement. One improvement that could influence education in all areas would be to find the ways and means to recognize and to hire administrators with good critical thinking abilities and to raise the level of critical thought amongst those already in the field (See Chapter 4: Recommendations for

Administration and Leadership). Maccaby (1981), in his book The leader: A new face for American management presents a strong argument for the leaders of today to be more consultative and less authoritative than in the past. He suggests that leaders in our turbulent times must care about people, and identify with their strivings for dignity and self-development, exhibit flexibility towards organizational structures and a participative approach to management thereby sharing rather than storing power. This profile of leadership is consistent with one which views leaders as critical thinkers. One further recommendation here would be to examine the leadership program offered by the Department of Educational Administration, University of Saskatchewan for its congruence with this focus and the extent to which it includes development of critical thinking abilities and attitudes. (See Chapter 4)

Looking beyond this to our entire provincial system of education, both as a social institution and as a bureaucracy, we could examine ways the system might change that would increase its capacity to support critical thinking at all levels. Kerr (1984) analyzes the barriers to integrity within western pluralistic societies and concludes that in order to strengthen personal autonomy and critical reflection:

1) persons in bureaucracies should be given as thin a definition of their work as possible; (A "thin" definition would be one that leaves as much authority and decision-making as possible to those people closest to the situation around which choices must be made) 2) professionals should offer their evaluations as possibilities for consideration and not as prescriptions; and, 3) products of a research system should be considered useful only in so far as members of the society appreciate the theory-dependent nature of the facts generated by that system. In education this would mean allowing room within any job in the educational hierarchy for individual interpretations and creative solutions

(within the boundaries of human rights); for a public information program that portrays educators as professionals but not experts and the products of educational research as being correct within the boundaries of the theory(s) that generated them,- thus reminding the public that other theories and perspectives are possible. This should encourage a healthy and rational skepticism towards quick and simple solutions and dogmatic stances by people both within and outside of educational institutions.

When examining the practices of critically aware teaching and learning within the classroom, several suggestions can be made. Costa (1985) analyzes teaching into four activities which teachers typically attend to, namely, questioning, structuring, responding and modelling. Some guidelines for critical pedagogy can be offered in each area. In addition, a general examination of content for critical practice will be undertaken. More specific analyses of how the subject areas might be reviewed or strengthened to support critical and/or creative thinking will be left to Chapter 4.

Questioning. A variety of frameworks can be used by teachers to improve their use of questioning intended to lead to reflection. Some frameworks are superior to others however in their ability to elicit critical reflection from students. While Bloom's taxonomy of thinking processes is perhaps the best known of these it has also been the target of criticism which challenges its hierarchical structure and the difficulty (experienced in practice) of keeping the levels separate. Further than this, many textbook writers and educators have failed to appreciate the true depth and breadth of the evaluation level. It has been the author's experience that the evaluation questions suggested in most textbooks or developed by most teachers are not particularly evaluative in the critical sense. Rather they often include reference to whether one liked or disliked a particular story, activity or end product followed by the familiar "why or why not?" Answers to the "why" questions are usually left at the level of "It was funny." or "It looks nice.", - further probing failing to get beyond this partly because more reflective questions are not usually included in the textbook. A different focus for evaluative questions will be suggested later.

Costa (1985) uses a framework which encourages teachers to make use of three types of questioning: 1) input questions which are intended to help students attain information (e.g.) What new characters were introduced in this chapter?; 2) processing questions which are intended to help students make sense of gathered information (e.g.) Recalling the outline which you used to develop a character sketch as one possible model, can you think of some categories which you could use to group or organize the information you have collected on explorers?; and, 3) output questions which help students apply and/or evaluate information (e.g.) Can you think of any exceptions to what our text tells us about countries' economies that are dependent on only one crop?

Questioning as a critical process has been described well by Drake (1976) and Hullfish and Smith (1961). They stress two levels of questioning in any subject area. The first level simply elicits an opinion or fact. Whether or not the student's answer is considered by the teacher to be correct, the teacher continues to question at the next level, -the level which asks for grounds or reasons for the fact or opinion which is put forth by the student and/or asks for alternatives to the student's initial response. This type of questioning leads directly into the critical thinking process and to a recognition of when more information is needed.

Drake and Hullfish and Smith, in stressing the importance of dialogue teaching, separate out from their recommendations the common practice of simply going around the classroom and giving everyone their say. They argue that such a process can be quite mindless and should be replaced with one where once the range of beliefs has been established, each new contribution should either add something to the development of grounds for these beliefs, seek or give clarification of terms or concepts, question grounds or refute previous contributions through use of substantive or principled backing. When teachers question consistently at this level, it is hoped that their students will incorporate critical questions and analysis into classroom discussions.

In further reiterating what we believe constitutes a critical focus for questioning, Hullfish and Smith's (1961) analysis of teaching as "inquiry into meanings" is useful.

> Teachers should recognize that the initial answer received from a student is but the starting point of a process in which both teacher and student give themselves to the task of engaging in communication in order to gain and share understanding. This is not the place to stop and place a mark in the book. The fact is that a "right answer" has no greater educative value than a wrong one. What the teacher does after getting an answer will determine its educative function. (p. 197)

An important cautionary note must be sounded here. Hullfish and Smith do not intend this to mean that truth isn't important, or that students should be left with a false impression regarding what the teacher considers to be the correct answer. Rather, they are pointing out that when we wish students to learn the processes and attitudes of critical thinking, a wrong answer can be a useful starting point for further questioning and reflection. What is desired is that students be required to produce evidence for their answer, to retrace the reasoning that led to it, in both cases. This would mean that giving either a correct or incorrect answer would involve the same amount of risk for the student and support the critical understanding that all conclusions require supporting evidence and argument.

An examination of questioning practices which relate positively to critical thinking is not complete without mention of two other points. First, critical questions begin with teachers who have analyzed in advance the function which questioning will play in a lesson. They must have a clear understanding of their own purposes in using questions and be able to recognize the difference between a question which is intended as a means of maintaining class control, one which tests to see if a student has read his/her assignment, and one which is intended to foster further reflection and exploration. Second, it should be noted that when questioning leads to critical dialogue, those who are silent are not necessarily uninvolved. When discussion proceeds as a genuine search for clarity or justifications for beliefs it is likely to awaken the minds of all those present. A search of students' faces by an experienced teacher can verify whether this is the case. Finally, critical dialogue is sustained best by a classroom environment where all members are sensitive to the tendency of people to identify emotionally with their own ideas. Students and teachers need to be encouraged to respond to ideas not to the qualities of persons expressing these ideas.

Structuring. Structuring includes all of the ways that teachers organize their classrooms for learning. It involves use of time, energy and resources and the rules and routines which guide action. Drake (1976) suggests that a classroom should model a democratic organization as closely as possible given the age and experience of the children. One of the first foci of the critical process, then, would be the mutual establishment of rules to govern classroom behavior. Drake suggests (and my experience leads me to concur) that when students are encouraged to explore the concept of "fairness" prior to a rule generating activity and to openly discuss justification for any rule, teachers need have little fear of biased rules resulting from student input.

A second aspect of a democratic organization is that every member is accountable to the group for the rules which have been established. The teacher needs to be a special case of this accountability in that he/she assumes a position of authority and leadership within the classroom. However, the authority which justifies this leadership must come more from the teacher's greater knowledge base and consistent moral conduct than simply from the role itself. The fact that a person is the teacher in the classroom rather than a student should not be adequate justification for the breaking of a classroom rule such as: No one is allowed to ridicule other class members for their beliefs. (See also Malikail and Stewart's discussion of this point in Personal and Social Values and Skills, p.72-74).

In discussing other aspects of classroom structuring, Costa (1985) suggests that a variety of interaction patterns must be planned for throughout the school day or week. These patterns should include individual, pair, small group and large group activities to allow for the participation of all individuals at a level where they feel comfortable.

When teachers are serious about allowing time for reflection and critical dialogue then selection of materials and amount of content to cover must be done carefully and critically with the understanding that some trade-offs will be necessary. Questions such as: Can I leave out this review unit?, Is this chapter one which students could examine through a homework assignment? and, Could my science and health lessons on body systems be integrated and taught as one unit? will need to be asked.

Beyond finding the time for critical reflection one must find the appropriate vehicles. Where our goal is to have students go beyond content to seek out the structures which organize it, the theories which support it, the unexplored assumptions and justifications for facts which are contained in it, then more than one source of information and more than one perspective on the content is often necessary. Use of a variety of sources and of types of sources is encouraged. Students should also be given the opportunities to select from a limited range of choices, those specific assignments or materials which, as a start, most closely reflect their interests and experiences. In this way is meaning created. Students are more likely to be committed to further exploration of those topics in which they have sufficient understanding to build the bridges to new meanings and which feed into their own purposes. In structuring a classroom, teachers must also be aware of the barriers to critical thinking discussed earlier and prepare strategies which would deal with them as they arise. Such strategies would include: the use of analogy or metaphor when new information appears so foreign to students that they cannot grasp it; searching for connections in students' store of knowledge and experiences which would facilitate processing of new information; and consistent avoidance of ridicule of students' beliefs together with support of people's right to hold different opinions and values where these don't violate basic human rights. (One source of universal human rights from which to base decisions about such violations is the United Nations' Chapter of Human Rights and Freedoms. The Canadian Bill of Rights can also be used.)

A final point to be made under structuring is that when fostering critical reflection, teachers must have thought through sufficiently the purposes behind all the material which they present, the ways in which they present it and the resulting tests and assignments. This is so partly because the teachers' choices must stand up to the critical scrutiny of their students. Once reflective habits are established, they turn upon all of life's experiences to search them for their underlying meaning. Teachers must be prepared, then, to meet students queries about the relevance, usefulness or purpose of any particular classroom activity though students may not always understand or accept the rationale being offered.

Modelling and responding. Much of what needs to be said under modeling and responding has been suggested already at those points where teacher questioning or structuring interact with teacher character. The most important aspect of both behaviors is that of the teacher's personal and moral character. While Nummella and Rosengren (1986) say that the teacher's ability to generate trust and affection is crucial and that this "ability stems from the sense of genuineness, of 'realness', of deep concern and integrity which the teacher projects" (p. 51), we would suggest that what is more important than "projecting" a sense of genuineness or integrity is that a teacher be a genuine and ethical person. Students are not easily fooled by mere "show". Classrooms and schools often produce situations of conflict or tension where facades break down. The type of moral character which best serves a teacher throughout the school year is one which rests upon well thought out principles of human conduct which have been integrated into the teacher's most important values and beliefs. Like much of critical thinking, this is easier to say than to do. It is, perhaps, an area which teacher education courses need to look at more carefully. One important reminder for beginning and experienced teachers alike is that the work of building a moral character is never finished - life in schools provides teachers constantly with new issues or dilemmas which require a rethinking of previously accepted positions or a reinterpretation of situations in light of ethical principles.

In critical thinking, the more critical ability teachers posses the more they value it and the more they are in a position to foster it in their students. Teachers whose own egos are in constant jeopardy are not likely to welcome student questioning of content or purposes for classroom activities. However, the subject areas in which these same teachers have the most interest, knowledge and competence will also be the ones in which they are most likely to allow students some scope for critical reflection. There is not, nor will there ever be, a substitute for mastery of substantive content. What is being recommended here, therefore, is that teachers should continue to have major areas of study in their teacher training programs, - areas which will support their classroom assignment through allowing for study in some depth of at least two subjects or disciplines.

A few specific practices under responding should also be mentioned. Costa (1985) concludes that neither the use of praise nor of criticism are particularly helpful. Responses more productive of further reflection are those of increasing wait time after a question has been asked and clarifying further the students' responses to show either that you understand them or need more information. Drake (1976) and Hullfish and Smith (1971) also recommend a slower pace to classroom dialogue to allow adequate time for reflection. The author has found that allowing students three or four minutes to jot down ideas in their notebooks before opening up a question for discussion also works well in creating an environment where students believe that thinking a question through before answering is both necessary and expected.

If a teacher believes that everyone in the classroom is capable of reflection then it is important to find ways to have everyone contribute in some way at some point. A situation where two or three students monopolize discussion should not be allowed to continue. Perhaps the most important response of the teacher to students' contributions, however is the one recommended earlier of responding to a student's answer with a further question that demands conceptual clarification or grounds for the belief.

All that has been said in the discussion of critical pedagogy relates to the type of model which the teacher's behavior provides. Costa's (1985) summary of the important consistencies to strive for in our teaching is worth reproducing here.

> .If listening to one another is a valued behavior of cognitive education, teachers who listen to students will greatly enhance the probability of achieving this objective.
> .If solving problems in a rational, scientific manner is valued, students must observe teachers and administrators solving problems in rational, scientific ways when problems arise in the school or classroom (Belcher, 1975).
> .If restraining impulsivity is a characteristic of intelligent problem solving, students must witness teachers and administrators reacting calmly and patiently during stressful situations.
> .If teachers desire students to understand others' points of view, values, and differences (overcoming egocentrism), they will accept students' differences.
> .If teachers want students to become enthusiastic about thinking, they will demonstrate enthusiasm about challenges, puzzles, and complex tasks requiring thought (Rosenshine, 1970). Emulation of significant others is a basic motive for learning. Yet if we are "do as I say, not as I do" educators, then students will easily and quickly sense this incongruence between our behaviors and our stated values. The credibility gap that results can lead to hostility, frustration and confusion. In the last analysis, there is probably only one person's behavior we have the power to control, train, and modify: our own! (p. 138)

Content. While how content in each subject area may need revision to support critical and/or creative thinking will be dealt with later, some general comments can be made here.

An understanding important to curriculum developers would be that of distinguishing concept development from the acquisition of facts. Sieger-Ehrenberg (in Costa, 1985) defines a concept as a

> ...mental image of the set of characteristics common to any and all examples of a class. Evidence of conceptualization is the learner's demonstrated ability to consistently distinguish examples from nonexamples by citing the presence or absence of the concept characteristics in individual items. (p. 163)

She notes further that all concepts are abstract and can not be taught, like facts, as discrete entitities which can be classified as "right" or "wrong".

Concepts are the building blocks for learning principles and acquiring values and attitudes related to a specific subject area. Olesen (1987) has argued that Social Studies curriculi be organized around concepts rather than facts as the focus of required learnings. This approach is also used in Hart's (1987) framework for curriculum development in the Sciences. Conceptual analysis of each area of study appears to be a reasonable procedure for curriculum development supportive of critical and creative thought processes and is recommended here. (See Chapter 5 for specific recommendations relating to use of conceptual framework in curriculum guides.)

McPeck (1981) argues for curriculum revision with an epistemological emphasis which would supplement "the dominance of facts and skills with an emphasis on understanding their justification (p.158.)" McPeck does not in any way dismiss the importance of developing knowledge of the concepts and propositions of a field but rather argues that such knowledge is not sufficient. To get beyond the level of information to that of genuine understanding together with an ability to critically reflect upon the knowledge under study also requires (as was noted earlier) a knowledge of how one would go about testing such knowledge for its correspondence to truth. McPeck (1981) also outlines how one might approach such revision of curricula.

> As a first step, my inclination would be to have curriculum specialists from specific fields join forces with epistemologists who have an interest in those fields in order to develop epistemologically oriented curricula for specific subjects and also to develop appropriate training methods for teachers. In some cases this might simply involve recasting familiar materials into an epistemological framework, while in others it might involve the development of entirely new materials. In all cases, however, the epistemic foundations of various facts, beliefs and methods of procedure would be systemically included as an integral part of the subject; and test questions would be designed to see that understanding of them had been achieved. If short, the epistemology of a subject

> would not be simply an additional aspect to be studied when time and convenience permit, but a central framework around which the subject is built.(p.158)

How much this approach lends itself to the development of curricula which also reflect the stages of child development related to differing content for each grade level is still to be debated. Nevertheless, as a general approach to critical thinking it has much to recommend it.

This section will conclude with a summary statement as to how the position on critical thinking being recommended here relates to the Core Curriculum Committee's Program Policy Proposals (1986) in their selection of core subjects and common essential learnings. Critical thinking and Communication Across the Curriculum have probably the greatest overlap, language development being essential to development of critical thinking and critical reflection fostering further language development. Creative thinking, independent learning, numeracy and personal and social skills and values are also necessary to a greater or lesser degree for critical thinking. This is particularly the case for sound development of the personal and social skills and values being recommended. We have shown how dispositions of fair-mindedness, tolerance, and rational skepticism depend to a large extent on the development of self awareness, empathy and recognition of social responsibility. Technological literacy, however, appears to be more a vehicle for the employment of critical thinking skills than the reverse of this. The arguments contained in this paper point to the necessity for students to have a broad knowledge base which includes knowledge in all of the major fields or disciplines internationally recognized as part of being an educated person. The required areas of study selected as Core Curriculum for Saskatchewan schools appear to be the necessary and sufficient ones for the development of critical thinking.

# CHAPTER III

## CREATIVE THINKING

As was noted in the introduction, creativity is not treated in the following discussion as a unique ability or type of thinking but rather as all thought which leads to the creation of new thoughts, objects or experiences. Creative thinking is considered to interact continuously with critical thinking and to be built upon a combination of innate abilities, supportive experiences, knowledge from one or several disciplines together with the tactics or processes which make up those areas, self knowledge, and strong purpose.

Understanding of creativity has been slow to develop partly because definition of this concept has been influenced by diverse lines of research which sometimes produced conflicting views and partly because its original identification as one general, broad-based, across-contexts ability or type of thinking appears to be in error. Gardner (1986) suggests that its definition has also been subject to distortion by predominant societal values. I concur.

In education, the packaging of "creativity-enhancing" recipes has taken the form of provision of general techniques such as brainstorming or visualization exercises which are supposed to be effective across subject areas. Such provision is not adequate for the perspective on creativity being presented here. Creative thinking is considered to be as dependent upon self knowledge, attitudes and values, knowledge and methods from specific subject areas as is critical thinking and thus technical prescriptions are equally inadequate. In addition, creative thinking appears to be bound to some extent by innate abilities making the form creative products will take very much an individual matter.

Research such as Gardner's (1982) on the development of creative thinking in young children or John Steiner's (1985) which examines the development of the mature artist, scientist, philosopher or writer, lend strong support for this view. In addition, the accumulation of observations from teachers working in educational settings with depth and breadth of provision together with student choice of daily activities (Bussis, Chittenden and Amerel, 1976; Central Advisory Council for Education, 1967) has also contributed to a picture of the uniqueness of the individual student's complex of abilities and the correlation between these and long term preferences for creating particular types of products.

Creative thinking will be examined in light of research into hemispheric specialization, the lives and thoughts of creative individuals, developmental theory, and the implications of all of these for education. The discussion which follows will also be bounded by the view of creative and critical thinking presented in the introduction. That is, one which see critical and creative thinking as thought processes which are necessarily interrelated.

### The creative left and right brain

Perhaps the greatest impact upon the development of educational curricula focusing upon creativity has been the growing body of findings supporting hemispheric specialization in the human brain. While this research has not been focussed specifically upon educational implications nor has it reached a level of comprehensive theoretical development related to learning which would warrant such applications, it has been referred to frequently in educational creativity-enhancing programs. For this reason it demands further scrutiny.

The work of Roger Sperry and his colleagues (1972), Galen and Orastein (1974) among others, has led to a general picture of brain specialization. Sanders and Sanders (1984) have simplified the basic findings as follows:

- In most people the left hemisphere controls language, the sense of time and the right physical side of the body, takes in data logically and analyzes it for details.

- The right hemisphere controls spatial relationships, imagery and the left physical side of the body, takes in data holistically as in a picture and uses images, metaphors and life experiences to create conceptual understanding.

- Both hemispheres operate continuously, function independently and in conjunction with one another at all times.

As research into hemispheric specialization continues, however, contradictions and inconsistencies appear. Holding a critical perspective on this body of research might lead one to conclude that is is not developed sufficiently for educational applications to be made.

Nevertheless, recognition of hemispheric specialization has led to an embracing of "right brain" approaches to learning by many curriculum developers and educators. Support for an increase in teacher methodologies which incorporated greater use of metaphor, story and visual symbols was partially based upon perception of an imbalance in teaching practices where logical deductive methods and verbal presentations predominate. Views such as the following by Sanders and Sanders (1984) are common in creativity primers:

> Repeated instruction geared to facts and details, sequential ordering, and pre-determined answers (the common results of lecture, structured discussion, text-book reading, drill and practice; and demonstration teaching) forces a left-hemisphere dominance that tends to ignore right brain creativity and conceptual ability. The result may just be the continued development of an adult population that is highly competent in left brain information assimilation and is handicapped in right brain intuitive perception and holistic understanding. (p. 19)

Hindsight suggests the problem was inadequately conceived and thus the solution overly simplistic, if not misleading.

A better response to increased understanding of hemispheric specialization for an education system such as Saskatchewan's which endorses the continued importance of a core body of knowledge, a move towards educators taking explicit responsibility for affective knowledge, together with an emphasis upon creative and critical thinking and independent learning needs to ask how theories such as that of hemispheric specialization relate to development in all of these areas. A broader question such as this is helpful in assessing whether educational implications can be drawn from the new theories of cognition. The development of critical and creative thinking proposed here acknowledges the complexity of the educative endeavour and the importance of finding frameworks for education systems which are consistent across purposes and with ultimate ideals. That is, where gains in one area enhance rather than inhibit gains in others.

Problems with applications from educational research in the past have often stemmed from a failure to recognize the importance of content and methods being consistent with ultimate purposes and that while every trade off involves losses as well as gains, some losses are more significant than others. In education, when we have opted for the quick, one-shot solution we have lost depth of knowledge (including self knowledge) and increased doubts as to the ultimate meaningfulness or import of the educational enterprise itself.

If the research in hemispheric specialization can be considered to have had a positive impact upon education, perhaps it has been in broadening our perspective upon appropriate methods for creating understanding of the subject matter being presented. New respect for the educative potential of the metaphor, the analogy, and the visual presentation has been one result of discoveries relating to the functioning of the right cerebral hemisphere. It is not necessary, however, to ignore the continued importance of logical analytic thinking to the comprehension and evaluation of all school subject matter. Within the framework of this paper, increasing the creative abilities of our students involves a response on several fronts including:

1. Provision of a broad educational base from which individual students may discover their particular interests and talents.
2. Ensuring that each subject or field of study incorporates opportunities for practicing creative and critical thinking and methods of presentation which embrace the appropriate use of all of the brain's, specialized functions.
3. Development of curricula and teacher education courses which stress that methods of presentation must vary to match subject matter to be mastered together with the purposes for its inclusion.
4. Provision of student choice of assignments or projects within a structured range of choices, and of learning experiences which include following through on choices to some experience of synthesis or repleteness. (See Chapter 4, Example 5)
5. Recognition of the difference between learning a skill, an attitude, a process or a concept. Concomitant recognition of the degree to which affective factors are involved in each and that differences include length of time in which each could be developed or acquired.

While these principles remain at a very general level they form the base for arguments for more specific revision of curricula, teacher education or assessment of students and programs.

The recognition of larger purposes for education beyond acquiring knowledge solely as an end in itself or as a means to a "job" is implied in the new goals for Saskatchewan education and in the common essential learnings. The necessity for specialization to proceed from a broad knowledge base including social and moral knowledge was supported by the definition of core curriculum to include both required learnings and Common Essential Learnings. Where creative thinking is concerned these are moves in a consistent direction, - viewing creativity as solely a matter of improved right brain functioning would not be so consistent.

We are arguing rather that each student needs exposure to possibilities to think creatively and critically in all of the subject areas and that they need opportunities to explore further those areas in which they have particular talent or ability. (See C. Keston's Independent Learning for further support of this view.) Perhaps particularly in those areas for which students have some aptitude, will creative and critical thought have a chance to achieve depth.

Understanding of how creative thought has led to achievements in the sciences and arts requires understanding of how it is best sustained. Such understanding has been recently moved forward by studies of the mature scientist or artist. One study which has focused extensively on the childhood interests and activities of and the formative influences upon creative individuals offers educators some clues for supporting the creative potential of their students. The assumption underlying the next section is that what works for great scientists and artists can also work for students. Therefore, implications from such work will be examined next.

### The life-long process of creation

> Creativity requires a continuity of concern, an intense awareness of one's active inner life combined with sensitivity to the external world. (John-Steiner, 1985, p. 220)

John-Steiner's synthesis of how creative endeavors are best supported is built upon an examination of the journals of creative individuals in the sciences and arts, extensive interviews with such individuals and analysis of much current psychology and philosophy related to learning. She concludes that while the dominant modes of inner thought and outer expression differ greatly from individual to individual, particular attributes of persons and processes can be identified as most conducive to sustaining creative work.

Her closing summary of these common attributes and processes include the following points:

1. The shaping of a distinctive voice in the sciences and arts requires a profound knowledge of one's discipline and of the tools of the mind. (By tools of the mind is meant creative and critical thinking processes, abilities, and techniques such as imagining, interpreting, analyzing, analogizing, etc.)
2. Such knowledge is strengthened in its development by work with mentors - by the young scientist or artist's contact with older creative people, and by participation in a community of artists or scientists pursuing work similar in its demands but not necessarily in its content. To intensify an inquiry and develop a sense of commitment to creative life the learner needs models, teachers and collaborators.
3. To focus knowledge into a unique individual contribution young thinkers also require ways to exploit the tension between knowledge of their culture, its history and values, and their sense of individual identity. Development of a dominant mode of inner thought and outer expression such as that provided by sound, verbal and non-verbal notations, movement, vision or language, sharpens this focussing.
4. Artists and scientists studied by John-Steiner agreed that the creative process of any individual must have regenerative aspects and that this is most often provided by an aspect of character identified as intensity. This contribution of intensity to sustaining creative work has been described well by Vivian Gornick in Woman in Science (1983) and is cited in John-Steiner's summary.

> A scientist or a writer is one who ruminates continuously on the nature of physical or imaginative life, experiences repeated relief and excitement when the insight comes, and is endlessly attracted to working out the ideas. (p. 40)

5. Content for the creative life comes from the individual creator's sensitivity to both inner life and the outer physical and social worlds, openness to memory or past knowledge and an ability to scan the surroundings for new stimulation and data. Many of the artists and scientists in John-Steiner's study reported use of imagery and insight in their generative thinking which later became worked out carefully in another medium. A similar perspective upon the creative individual's sensitivity to sources which are difficult to validate empirically comes from a poet who is not part of this study. George Keithly (1984), in a discussion of sources for his poems, argues that the distinction between conscious and unconscious thought is a false dichotomy - for the creative individual, all mind is one.

> It is an unfortunate fact that our understanding of mentality is influenced by the economic order of our society. Only those aspects of thought which are productive, which lead to the making of careers or objects or money, are considered conscious and real. And so our dreams, intuitions, impulses, fantasies, poetry, all are confined to what we call an inner world, while the real world rolls on, with or without the diversity of the imagination. In this whirling world we hear the words of myth and poetry used in a pejorative sense, to indict ideas that lack empirical validity; notions that cannot survive the test of experience. But we know that these newly met, newly encountered images work within us with a vitality and force and purpose at least as strong as anything in that pragmatic world. (p. 45)

The work of the late Carl Jung, a psychologist who pioneered study of the therapeutic and dynamic roles of the unconscious in a happy and productive life supports this vision of the unconscious mind as an active participant in creative thought. (See for example his overview of this role in his introduction to Man and His Symbols, 1964).

6. Creative work, if it is to be sustained, requires both patience and courage. This is so for a number of reasons including that original contributions to any field can also be controversial contributions drawing criticism, even ridicule, from people both within and outside the field. John-Steiner also

notes that creative work often involves an openness to emotions which many of us would find uncomfortable. Finally, creative enterprises always contain the possibility of failure and creative individuals are seldom satisfied with their present level of achievement. Thus courage is necessary to seek the unknown, expose the fruits of our findings to others, and to go on despite feelings of dissatisfaction or failure. John-Steiner sees the source of this courage to be more often connected to the intensity of the creative individual's involvement with the work at hand than with any special amount of self-confidence.

The six areas above form useful background understanding of the creative process and of creative adults but are not presented at a level of specifity desired by educators or curriculum developers.

Implications for educators. As was the case with critical thinking, more specific development of principles for fostering creative thought requires a substantial grasp of the subject matter and methods of each individual field. While some general educational implications can be drawn from John-Steiner's work, their translation into specific practices in each of the sciences, humanitities and arts can only be done by those thoroughly conversant with the same.

The general implications include support for the practice of mentorship and more concentrated attempts to strengthen connections between a school and the artists and professionals within its community. Greater use of a diversity of symbol systems (beyond those provided by numbers and words) in the presentation of curricular knowledge and the provision of activities and assignments should also be encouraged. (See Chapter 4 for specific recommendations in these areas.)

It is more difficult to draw educational implications from recognition that intensity is an important quality of the highly creative (or critical thinking) individual. Classroom instruction is largely group instruction driven by curricular, rather than individual student, demands. Time pressures, the need to cover all the material one is responsible to cover and to extend recognition and assistance to all students, renders teacher-support for an individual's intense interest in one particular area unlikely. In addition, it might be easier to say why this is so then how the situation might be changed.

As a first step, teachers must believe that offering support to creative endeavors is important or at least a part of their teaching responsibilities. Such belief is supported or created by seeing the ultimate purpose of education as assisting in the development of a better world. Beyond the desire to support a student's intensity of interest knowing how to give this support is also necessary. (Although my experience of teachers and teaching leads me to believe that this "desire to support" leads directly to the type of analysis of teaching practice which creates the ways and means for any individual teacher undertaking it.)

One of the difficulties which must be acknowledged here is that there is something inherently contradictory about dictating to others the pedagogy supportive of critical and creative thought. First, because my discussion of these thought processes has emphasized their individual nature both on the human dimensions of personal commitment, values, and interests and the subject matter dimensions of the unique concepts, methods, and their grounding in each field. Second, because classrooms are unique in their combinations of a teacher's interests, abilities and values and these qualities of students. Prescriptions which ignore the unique and dynamic nature of any one classroom situation are potentially more harmful than helpful. My analysis is partly in an attempt to recognize these individual and changing aspects while bringing together those common elements which could form part of a prescription for practice.

Teachers need ways to recognize intensity and commitment to learning endeavors where they exist and ways to create and to foster these qualities. It is important, then, that teachers permeate each school week with opportunities to become familiar with their students' interests, abilities, sensibilities, and unique responses to life. Practices which create such opportunities include journal writing, class discussion, and student choice in assignments and learning activities. These choices should include a sampling of assignment possibilities from visual, oral, musical, numerical, physical or written presentations. A good teacher-response to the contributions which result from such opportunities is best described as a delicate balance between recognizing unique aspects of a students' work and the amount of struggle or effort underlying it, requiring a student to go beyond the creation in some way, and, supporting this challenge through concrete suggestion or questioning which leads the student to new insights in relation to the work. Involving other students in this type of analysis is also helpful and can be productive of new insights for more than simply the individual student involved.

Teachers must learn to analyze what they want, that is, what they consider to be the important features of any particular assignment, discussion, or activity and to make these standards clear. Following this, teachers and students must be led to an understanding of evaluation as part of any learning process and as necessary for further development or improvement, rather than as simply part of the process of assigning grades. Once students have become familiar with some of the possible standards for any piece of work, teachers should require that they analyze the strong and weak features of their own work before hearing the teacher's assessment.

A response to John-Steiner's point about the importance of an individual creator's sensitivity to potential sources of new stimulation or data would be to suggest that all of the above discussion in this section is applicable. In addition, depth and breadth of provision is important. This means that a single textbook approach is inadequate and that understanding is valued over memorization.

An enthusiastic and open response to the knowledge-creation process often begins with a teacher who exemplifies this type of involvement. Perhaps "joie de vivre" is the quality most needed to sustain teachers - particularly those who would foster a creative and critically reflective approach to learning. Part of the discipline necessary for teachers is that of thinking carefully about the potential of a student's question, statement, or creative product to lead to new learning before commenting upon it. Sometimes this will result in a teacher seeing the necessity to change or expand their standards for assessing the statement or product.

Another way to state the points made above is to say that teachers need to believe in the importance of quests for truth, beauty, goodness, and justice-believe these are valid destinations for journeys of knowing, believe in the potential for intellectual, aesthetic and moral growth both in themselves and in their students. While a teacher should be one who values the original response, this value does not necessitate a lack of honesty. Teaching demands of teachers that they continuously refine their standards for their own conduct and that of their students. This includes analyzing and reanalyzing the possible sources of insights and the standards for achievement in any subject area.

Richard Wertime's (in Lockhead and Clement, 1979) concept of "courage spans" also offers a useful perspective here. Wertime developed the concept of courage span from the better known educational concept of attention span. He defines it as "the time which elapses between the taking on of a problem and an abandonment of that problem (p.196)." He cites two main factors as involved in the length of a student's courage span: the importance of the context of a learning problem to the student's general sense of worth; and the anticipated difficulty he will have in solving it. Beyond teacher awareness of these two factors, Wertime argues that students must be made aware of the power of the mind to aid in solving problems "subliminally" where students' concern with the problem persists as something kept in the background of their minds while their attention is focused elsewhere. Persistence to the point of preoccupation with a learning problem during the time of actively focusing upon the problem and during periods of rest or thought about other matters can lead to insight and/or reorganization of thought related to that problem.

The final chapter of this paper will look at recommendations for future development of both critical and creative thinking in Saskatchewan schools. Before turning to these, however, some final comments about the development of creative thought will be made. These comments will take the form of highlighting some school related issues and concerns.

## Developmental theory and educational practice

Development of classroom practice supportive of creative thinking requires a base which looks at developmental trends and evaluation or assessment strategies in addition to what has been outlined above. Gardner (1982) says that "it is the burden of developmental psychology to discern qualitativity different stages in physical, intellectual, and affective growth, the fundamental units and operations entailed in each stage, the factors contributing to the growth of each, and interrelations among them (p 210.) He argues that while developmental theories such as that of Piaget may have important implications for logical-mathematical and linguistic thinking they have serious limitations when it comes to understanding creative development.

Gardner argues that Piaget and Chomsky as well as other cognitive structuralists share a belief that the mind operates according to specifiable rules-that these can be uncovered through systematic examination of human language, action and problem-solving and that the options of human thought are preordained or limited in advance.

> "This makes their work especially problematic for a study of mind where the major focus falls on innovation and creation, as in the fashioning of original works of arts.
> To my mind the limitation implicit in the standard structuralist stance can be circumscribed by a recognition of one special feature of human thought - its ability to create and sponsor commerce through the use of various kinds of symbol systems. These symbol systems - these codes of meaning - are the vehicles through which thought takes place: by their very nature they are creative, open systems. Through the use of symbols the human mind, operating according to structuralist principles can create, revise, transform, and re-create wholly fresh products, systems and and even worlds of meaning.(p.5)

Gardner believes that stages that hold across cultures and across media can be identified for artistic development and that by the age of seven or eight the child has achieved an initial grasp on the major symbolic media of his culture. He calls the child of this age an "incipient artist" who possesses a rough knowledge of how symbols work in a raft of symbolic media, some knowledge of how to construe a work and some capacity to construct one on his own. "Only when it comes to the task of being a critic who, like Piaget's formal operator, must be able to reason on the level of words or logical propositions is the young child seriously deficient (p.213)." Gardner bases his belief on studies of young children in normal school settings as well as of individual children with particular artistic ability. He suggests that beyond the age of seven or eight changes in the child's artistic development involve quantitative rather than qualitative changes. Gardner sees Piaget's idea of formal operations useful in helping to understand the frequent (in our culture) loss of creative growth associated with the adolescent years and suggests that the achievement of formal operations during this period is accompanied by a more critical attitude. When the adolescent turns this criticism against her own work, she is most often dissatisfied with it. The lesson for pedagogy in this view is that the critical attitude towards works of art (including the child's own) needs to be nurtured slowly and consistently from a very young age. Along with specific practice in art criticism, the artistic skills of the various media need to be specifically taught and developed to a level where products will not be so unacceptable to the adolescent creator.

While Gardner's work offers one developmental perspective on the artistic growth of children, it contains contradictions and has not been fully validated. Further, a view of creative and critical thinking as interrelated in important ways requires a broader theory of human development - one which encompasses all of the forms of intelligence which were identified earlier (p.11). While the Piagetian framework covers a fuller range of children's thought processes, recent work such as that of Donaldson (1978) and her colleagues has thrown more of Piaget's ideas about the stages of human thought into question.

Donaldson and her colleagues undertook extensive research into young children's thinking using many of the original Piagetian tasks, but varying the questioning and comments and (if necessary) the structuring of the task itself, to give the child every chance of understanding the situation fully and grasping what was being asked of him. Their general conclusion was "that pre-school children are not nearly so limited in their ability to 'decentre' or appreciate someone else's point of view, as Piaget had for many years maintained." (p. 31) Accepting this conclusion would mean abandoning a belief in pronounced childhood egocentrism. Donaldson argues that most young children are able to take the point of view of the other, but that this ability is limited to situations and utterances which are personally meaningful to them. When what is required of them, loses this quality of being embedded in a meaningful context, many children's thinking patterns are inadequate.

Approaching creative thought from a developmental perspective offers us little which could be considered concrete. What research such as Gardner's and Donaldson's has done, however, is add support to a picture of developmental theories for education as being best viewed as having different propositions or hypotheses to offer within different school subjects and to be more individualistic and culturally-influenced than has been thought in the past. Perhaps the idea of multiple intelligences might be related here. For example, children with exceptional abilities in logical-mathematical thinking might achieve what Piaget called formal operations earlier than his theory specifies or than children whose abilities lie more in the bodily-kinesthetic or spacial domains.

Where creative thought is the issue, one conclusion that might be drawn from examining developmental theory in the light of research which contradicts some aspects of it would be to suggest that scope and sequence type of curriculum design which is focussed by age and stage theories of human thinking may not be that useful an approach. Curriculum design informed by knowledge of children's physical development and (culturally-shaped) social development together with a firm grasp of the field which is being translated into a school subject might be easier to justify.

A final point about creative thinking concerns its assessment in schools. Because creativity has been identified as good thinking within specific disciplines and as interrelated with critical thinking in important ways, general tests of creativity are not considered useful or valid. Creative thought is probably best assessed separately within each school subject and as embedded in projects or tasks rather than as being the focus of pencil and paper tests. See McPeck's (1981) discussion of this same point in relation to critical thinking.

# CHAPTER IV

## SUMMARY AND RECOMMENDATIONS

Education in Saskatchewan is taken to be ultimately a moral endeavor where concern for the future of the individual, for harmony within the global community, and for the survival of our planet is acted upon using reason and empathy, - creative and critical thought informed by the best knowledge available. Knowledge is considered to be constructed by humans, dynamic in nature and evolving from objective inquiry into the nature of our physical and social worlds together with influences from the history, interests, values and level of technology of the inquirer's time and place. Learning is developed as an interactive, synthesizing and not wholly understood process involving the learners' thoughts, feelings and experiences in ways that cannot be entirely separated. Language is felt to play a crucial role in learning and is an important vehicle for critical and creative thinking. Other symbols systems such as those provided by number, musical notation and the visual arts are important for both creative and critical thinking in the fields they are related to and also for insights into other fields. Critical and creative thinking are considered to be interrelated aspects of thought which have limited value used in isolation from each other. Within this framework, and given the theoretical development of previous chapters, recommendations can be made.

A number of principles can be established which apply across the subject areas as conducive to developing or supporting critical and creative thought. These principles relate to: the importance of eliminating pressures caused by time constraints wherever possible; the importance of establishing and maintaining a consistent focus on knowledge as constructed by humans and, therefore, as also in need of evaluation by humans; the necessity to provide (within each curriculum guide) as complete a description as possible of teaching procedures, practices, and contents being recommended to foster critical and creative thought; and, the importance of including methods, contents and assignments which relate to all the intelligences discussed above whenever such inclusion is feasible. Following the across subjects' recommendations, recommendations which apply to the individual subject areas will be discussed.

The structure of the final section will take the following form:

1. Rationale for a recommendation or set of related recommendations will be presented.
2. Statement of the recommendations.
3. Models, examples or counter examples, from current curriculum guides, texts, etc. which illuminate the intention of the recommendations will be included wherever possible.

General recommendations relating to curriculum development

Creative and critical thinking are both : interrelated aspects of thought which work to refine each other; and, thought processes which are largely dependent upon the particular subject matter of interest for the form standards, methods, and content will take. It makes little sense, therefore, to teach them as a set or sets of isolated skills.

RECOMMENDATION 1: CRITICAL AND CREATIVE THOUGHT PROCESSES SHOULD BE DEVELOPED FOR EACH SUBJECT AREA IN WAYS THAT REFLECT THEIR INTERRELATEDNESS AND THE UNIQUE CONTRIBUTION THEY CAN MAKE TO THAT AREA.

1.a The attitudes and values of the critical and creative person should permeate the curriculum, the teacher's methods and the school ethos and be understood by school teachers and administrators. This understanding should include how these attitudes and values relate and overlap with those developed under Social and Personal Values and Independent Learning.

EXAMPLE: The New Curriculum guides in Health, particularly the Division III Health Curriculum guide show how the attitudes and values of the critically and creatively oriented person can be integrated with the school subject matter under study.(See Example 1) The focus of Health Education (as can be seen in pages 20 and 21 of the curriculum guide) is a good example of how the theory about thinking, learning and knowledge outlined in this paper can be translated into practice. Notice that the approach used is one where the interaction between cognition and feelings, emotions and interests, forms the basis for the learning structure and that critical thinking skills such as awareness of one's own motives, interests, knowledge base, and the justifications necessary for one's goals are crucial to the learning process. A need for adequate information as a basis for action is stressed. The importance of both students and their teachers clarifying students' family values and personal goals is understood.

While this is one example of curriculum development which supports the values underlying critical thinking, particularly the values of autonomy, truth, rationality and self-criticism, it also shows the unique focus critical and creative thinking takes in the field of health education. Examples from the Science curriculum guides for Division I,II and III are harder to find, as are examples from the Social Studies guides prior to revision.

* * *

Creative and critical thought processes are supported by an epistemological approach to subject matter; that is by inclusion of explanations of the methods for acquiring and refining knowledge in each field and the standards or criteria for what counts as knowledge implicated in these methods. An epistemological approach would also be one where the major focus of classroom questioning is upon students providing reasons (arguments related to principles and to evidence) for their answers, ideas, responses or choices. It is also one where students are

## Level A: Extend Knowledge Base

EXAMPLE 1

## Acquire and Evaluate Health Education Information

| Steps to Guide Learning | Learning Principles | Relationship to Health Education | Teaching Strategies |
|---|---|---|---|
| 1. Respond to Health-related Stimuli<br>"Ho-Hum! Now What?" | Student interest is required for learning to take place. | The day-to-day world presents many stimuli competing for attention. Interesting classroom activities can raise awareness of health-related stimuli in their environment. | Stimulate interest/ involvement by: film, picture, poster, provocative statement, newspaper clipping, a question, etc. Allow/ encourage response. |
| 2. Recall Pertinent Information<br>"I already know ___________ ." | Start with what the students know. Students have already acquired a number of concepts regarding health-related practices at home, at school and in the community. | Ability to quickly recall pertinent facts and strategies in response to a stimulus is required day-to-day for healthy living. | Determine present knowledge/skills/ attitudes by: discussion, pre-tests, reporting, brainstorming, key words, word associations, buzz sessions, etc. |
| 3. Reflect on Present Use of Information<br>"Do I use the information? What keeps me from using the information?" | Identifying discrepencies between information and personal practices (cognitive dissonance) helps the learner focus attention on the need to look at available information. | Paying attention to discreprecies between known information and personal practices can trigger the need for corrective action/more information. | Encourage reflection through: checklists, inventories, dialogue with a mentor/buddy, time for private thought, discussion, etc. |
| 4. Research Facts and Health-enhancing Strategies<br>"Does what I know and do check out with what experts recommend? What else do I need to know or do? I want to find out _________." | Looking for specific information helps the learner focus attention on the topic under study. An abundance of information and also a lot of misinformation exists. The learner needs to learn how to judge as well as find information. | Knowing where to go for health education information, how to access and evaluate it, are skills required throughout life. | Broaden information base by encouraging use of textbooks, encyclopedia, pamphlets, authoritative resource persons, resource centres, community resources, etc. Provide information for students through films, film-strips, computer programs, video-tapes, demonstrations, lessons, panel discussions, guest speakers, etc. |

## Level B: Make Informed Decisions

## Gain Skill in Decision-Making for Health

| Steps to Guide Learning | Learning Principles | Relationship to Health Education | Teaching Strategies |
|---|---|---|---|
| 5. Define Challenge<br>"What is the challenge?" "The information tells me I should _________." | Relevance to the individual can be a motivating factor. | Defining the challenge is a first step towards achievement of health education goals. | Assist students to look at the information as a challenge by defining the problem for themselves or for people they know. |
| 6. Identify Alternative Strategies for Action<br>"To do this I might ____ or I might ________." | Scanning the range of options available increases the likelihood of an effective and acceptable one being identified. | There are a number of recommended health practices that merit consideration. | Assist students to think of many health-enhancing alternatives by listing, asking others, brain-storming, reading to find out, etc. |
| 7. Project Short- and Long-Term Consequences<br>"Will my decisions be the 'right' ones for me now and later?" "If I do ____ then ___________." | Establishing criteria and learning to use it requires practice, a skill often overlooked. Immediate gratification should not be the only criteria. Long-term consequences are important to consider. | Judging alternatives against criteria is an essential skill for lifelong learning for health. At this point in the process students should consider values of their home and society as well as other criteria. | Assist students to identify criteria/consequences for judging alternatives by listing, brainstorming, asking others, reading, hypothesizing, etc. |
| 8. Select Best Health-Enhancing Action<br>"Considering my circumstances, my family values, and my personal goals, I will ________." | Each student will have specific circumstances, family values and personal goals which will influence decisions. | Reflection and sound decision-making skills can help overcome negative peer pressure and reinforce positive peer leadership. | Assist students to select an alternative that is health-enhancing and appropriate to their circumstances by use of decision-trees, rank-ordering, rating scales, etc. |

assisted in developing ways to evaluate (using standards from the art or discipline involved) their assignments, projects, or creative processes. An epistemological approach is also supported by the practices of debating and journal writing (in all subject ares) and by the inclusion in curriculum guides and textbooks of biographical and autobiographical material on important contributors to knowledge in each field. The underlying idea here is that knowledge is created by humans, and that this creation necessarily takes a different form in each field or subject area due to the unique features of its substantive content; and the standard for truth and knowledge generation in the larger field. Understanding of these processes will lead to students who criticize and generate knowledge rather than simply "take it in" or passively accept what they are told.

RECOMMENDATION 2: AS A BASIS FOR CRITICAL AND CREATIVE THOUGHT, CURRICULUM REVISION SHOULD BE UNDERTAKEN IN EACH SUBJECT AREA AND (IN SOME CASES) SUB AREA, TO INCLUDE AN UNDERSTANDING OF THE EPISTEMOLOGY OF THE FIELD TO WHICH IT IS RELATED. DEVELOPMENT OF THIS UNDERSTANDING SHOULD BEGIN AT GRADE FOUR AND CONTINUE TO GRADE 12.

2.a Curriculum revision should include study of major contributors to a field (e.g.) Newton's contributions to Physics together with some discussion of his methods for theory formulation in relation to the predominant ideas of his era; Darwin's methods and contributions to Biology; the contributions of the French Impressionists to the visual arts, etc. Such study should build understanding of how these theorists or artists changed the field or the course of human life and lead to insights into how knowledge in that field has continued to evolve.

2.b Revision of teacher training "methodology" courses should be undertaken (where necessary) to correspond with this epistemological emphasis and should include examination of supportive pedagogy including the focus for questioning outlined in the rationale above and the use of debating and journal writing.

EXAMPLES: Perusal of current curriculum guides resulted in no strong examples of the approach being recommended here. However, the position paper on Technological Literacy (Reg Fleming, 1987) is built upon this same approach and is focussed upon the same type of curriculum development. The epistemological approach is one which examines:

What counts as knowledge in this field?

How are facts distinguished from theories? from opinions?

How is knowledge developed? (empirical methods? historical artifacts, etc.)

What influences knowledge development in this area? (technology, human needs, business interests, etc.)

To what extent does "the common man" have access to this knowledge?

How can theories in this area be refuted? counter theories be developed?

New Division III curriculum guides lack an introductory chapter establishing the various fields which make up Social Studies and their epistemological foundations but their inclusion of "Case Studies" of individuals and cultural groups supports epistemological understandings and could be further strengthened. Such case studies as those on page 61,65,66 and 211 of You and Your World, (Vol.2), Margeret Leier (1986) show how people influence public life but not how social science knowledge is created. The "Backgrounder" (p.22-23) on Karl Marx (Canada and the World Community, pilot edition) could make more of a point of how his work has shaped social, political and economic theorizing up to and including the present.(See example 2)

EXAMPLE 2

## Backgrounder: Karl Marx and his economic theories

(picture of Karl Marx--maybe from Soviet poster)

Karl Marx was a German writer and philosopher born in 1818. By the time he was twenty-five, his ideas had annoyed the government so much that he was forced to leave the country. He spent the rest of his life living in other countries, mainly France and Britain, where he wrote books. He worked with other writers, particularly Frederick Engels, to develop his economic and social theory. His most famous book was *The Communist Manifesto*, published in 1843.

Marx based his theories on a study of history. In each major era, he noted, there were two **classes** competing with each other. Classes were based on control of important resources, which Marx called the **means of production**. In feudalism, this was land. As time went on, the knights got more and more land, and the peasants got less. Eventually the peasants became so unhappy that they started a **revolution**.

(sketch showing knights vs peasants)

The result of the revolution was the formation of two new classes, based on new means of production. The powerful were factory owners, whom Marx called **capitalists**. The weak were the workers, called the **proletariat**. This was the condition Marx saw in Britain and France. Over time, history would repeat itself. The capitalists would get richer and the proletariat poorer, until another revolution occurred.

(sketch showing capitalists vs proletariat)

To change this pattern of history, people must organize a government that would put an end to competing classes. It would do this by distributing the means of production equally. This government would be called the **dictatorship of the proletariat**.

In time, this government would bring economic equality to everyone. This would bring an end to competing classes. Then the need for government would be gone, so the government would, to quote Marx, "wither away." People would live happily together, each working co-operatively and getting what he needed for a comfortable life. **"From each according to his ability; to each according to his needs."**

Marx tried to encourage workers to act with the famous ending to his book. **"Let the ruling classes tremble at a Communist revolution. The proletarians have nothing to lose but their chains. They have a world to win.**

**Working men of all countries, unite!"**

These ideas were used by Vladmir Lenin as the basis of his Bolshevik party. He and his followers took control of Russia at the end of 1917, and attempted to put Marx's ideas into action.

The guide for interns (The Internship, College of Education, University of Saskatchewan, 1986) contains a section called "Science Expectations of Intern" which supports the intent of recommendation #2. (See example 3, particularly points 6-9). The curriculum development framework contained in Science for Saskatchewan Schools: Proposed Directions (1987) includes a strong epistemological emphasis and includes supportive pedagogy and conceptual structuring. It is an excellent model, therefore, for curriculum supportive of critical and creative thought.

Examples of a critical focus for questioning were hard to find. The format of example #4 shows one way to have students think in terms of reasons for opinions and in terms of looking at both sides of an issue. It does not, however, show the place of factual knowledge as evidence for reasons.

A framework supportive of an epistemological approach (used by the author for research into social issues with grade six and seven students) is included below. (See example 6) It was developed from a perspective that sees arguments involving social issues as needing to rest on principles, and that principles must be backed by evidence which shows that they are being either violated or supported by the practices of issue. An example of a principle would be that "all humans are entitled to food, clothing and shelter as these are necessary in order to survive."

Following Malikail and Stewart's (1986) argument that first order principles such as this one do not require prior argument for their adoption, students could move to the level of showing whether the practices at issue supported or violated the principle. In other cases where the principle was not of a first order (ie. universally accepted as a human right), students would begin with establishing backing for the adoption of the principle. Evidence that the principle is being

EXAMPLE 3

## EXPECTATIONS FOR SPECIFIC SUBJECT AREAS:

To supplement the Guide to Intern Growth, the expectations listed below are suggested as necessary for interns teaching the following three subject areas.

**Science Expectations of Intern:**

1. Provides for a humanly supportive environment that encourages confidence and self-esteem in doing science activities; with special attention to girls.

2. Plans eclectically and demonstrates a wide variety of instructional techniques, strategies and skills in teaching science.

3. Formulates instructional plans which provide for individual differences and learning styles in science.

4. Possesses, or can learn quickly, an adequate subject matter background in science necessary for the lessons.

5. Uses psychological development and learning theories in the planning and analysis of science lessons.

* 6. Constantly portrays an authentic image of science, rather than the ideal image.

* 7. Points out how the lesson teaches children the strengths, values and limitations of science.

* 8. Contributes to the student's formation and understanding of the various and seemingly contradictory scientific attitudes (eg. objectivity/subjectivity)

* 9. When possible, shows social relevance of topics in the lesson, emphasizing the social context of science.

10. Helps to develop students' abilities to think critically, to solve problems, and to utilize science process skills.

11. Employs appropriate evaluation skills and procedures.

EXAMPLE 4

For each of the following issues, identify reasons that support each side of the issue.

*Issue*

| Student's grades should be based not only on how much they learn, but also on how hard they try. | Students' grades should be based only on how much they learn. |
|---|---|
| *Supporting Reasons* | *Supporting Reasons* |
| 1. This policy will encourage students who learn slowly. | 1. Teachers don't always know how hard a student is trying. |
| 2. ______________________<br>______________________ | 2. ______________________<br>______________________ |
| 3. ______________________<br>______________________ | 3. ______________________<br>______________________ |

*Issue*

| The best way to deal with crime is to give long prison sentences. | Long prison sentences will not reduce crime. |
|---|---|
| *Supporting Reasons* | *Supporting Reasons* |
| 1. ______________________<br>______________________ | 1. ______________________<br>______________________ |
| 2. ______________________<br>______________________ | 2. ______________________<br>______________________ |
| 3. ______________________<br>______________________ | 3. ______________________<br>______________________ |

EXAMPLE 5

## Arguments Relating to Social Issues

A. Types of Arguments:

1. Leads to good consequences
   Leads to bad consequences

2. Causes bad consequences
   Causes good consequences

B. Types of Consequences

1. Environment harmed
   Environment improved

2. Hazardous to health
   Improves health

3. Violates human rights
   Supports human rights

4. Violates the criminal code
   Supports the criminal code

5. Increases knowledge
   Decreases knowledge

6. Economy: arguments relating to amount spent or needed in proportion to other possible uses for the money.

C. Types of Evidence or Proof

1. Historical events
2. Statistics
3. Factual knowledge from reference books
4. Opinions of experts
5. Experiments, surveys and other tools of research
6. Personal experiences and accounts of others
7. Your own experiences/feelings/conscience

violated in a specific instance at issue must also be provided. The framework is built from:

1. Developing understanding of human needs.
2. Relating principles of human rights to human needs.
3. Analyzing types of arguments and selecting those which apply.
4. Gathering evidence that establishes arguments to support or refute principles or to establish that the principle is in fact being violated or supported in a specific case.

This framework can be used as a structure for written reports, oral reports, and debates. Following these reports with further discussion which involves students in evaluating the evidence presented as to its strengths, (credibility of sources, etc.) also requires students to think critically in the sense recommended in this paper. The author has followed this procedure with grade six and seven classes and found them to be capable of all steps from formulating an argument and gathering evidence to evaluating the evidence.

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RECOMMENDATION 3: CURRICULUM REVISION SHOULD BE UNDERTAKEN IN ALL SUBJECT AREAS WHICH DE EMPHASIZES THE SINGLE TEXT APPROACH (EVEN MORE FORCEFULLY THAN HAS BEEN THE CASE IN THE PAST), SUPPORTS THE PRACTICE OF SELECTION FROM AN ARRAY OF CREDIBLE SOURCES, AND WHICH PROVIDES CONCRETE INFORMATION FOR CRITICAL PRACTICE AND DEVELOPMENT OF CREATIVE THOUGHT.

3.a In order to support a multiple-source approach curriculum guides in each subject area, at each grade level, need to include a complete annotated bibliography of support materials including reference books, magazine articles, filmstrips, films, etc. which are readily available. This bibliography needs to be updated yearly and should include references for teachers' use as well as sources which are at a level appropriate for students.

3.b A model unit should be included in every curriculum guide which lays out in full: the potential sources of substantive content; appropriate pedagogy or forms of presentation; range of questions and projects for journal writing, class discussions, assignments and student evaluation practices; and, the integration possibilities within the unit. (If we are serious about decreasing teacher dependence upon textbooks and workbooks, we need to provide them with as much support as possible in developing alternative practices.

EXAMPLES: An example of the type of inclusion for this model unit, - one which focuses particularly on developing the type of range in students' assignments which draws upon multiple intelligences and symbol systems and allows for choice, is included below. (See Example 6)

Present curriculum development which also provides a good model of range in students' assignments is that of the new textbooks in Division III Social Studies, particularly those authored by Margaret Leier (1985). See Example 7 below from You and Your World (Preliminary edition, Volume 2), p. 268

3.c An appendix devoted exclusively to teacher questioning and discussion-fostering practices which support critical and creative reflection should be included in each guide. While Joan Tough's (1979, 1981) books on the development of language and thought in young children are excellent sources for such curriculum development in K - Grade 3, no single source can be recommended for middle or secondary levels where questioning practices will be much more dependent upon the individual subject matter.

3.d Model units should also incorporate examples of how metaphoric and analogical thinking can be used to create insights and build understanding in all of the subject areas. (Some source for curriculum

EXAMPLE 6

## ASSIGNMENT RESPONSES TO NOVEL STUDY: YEAR 6/7

### JANUARY-MARCH (86)

Each student is responsible for completing at least two novels this term and for completing two of the three choices of responses described below:

(1) CHARACTER

(a) A written character sketch including all of the elements outlined in your notes on character sketches.

(b) A poster containing character's name and several adjectives which describe this character.

EVALUATION

(a) Written character sketch will be marked for:

-accuracy of description
-originality and smoothness of writing style,
-vocabulary used
-handwriting
-spelling
-correct grammatical forms

(b) Posters will be marked on:

-attractiveness
-neatness
-quality of design
-choice of adjectives

(2) THEME

(a) An oral report describing:

-the main themes in the novel
-the author's point of view in relation to these themes;
-and containing a selection of music which relates to a main theme and explanation of why the piece of music was chosen or in what way it is related to themes explored in the novel

(b) A poster containing:

-the name of the novel
-and illustrating the main themes symbolically and in words.

EVALUATION

(a) Oral presentation will be marked on:

-accuracy of themes
-understanding shown of author's point of view
-appropriateness of piece of music
-public speaking ability

(b) Poster will be marked on:

-attractiveness
-originality
-neatness
-quality of design
-accuracy of themes

(3) [illegible]

(a) A visual presentation which includes:

- -a sentence describing the central problem in the novel.
- -four pictures portraying the four main events in the plot which relate to the central problem.
- -one or two sentences describing the event portrayed in each picture.

(b) A sheet of questions related to the novel which could be used by the teacher to test comprehension of this novel (ten questions).

EVALUATION

(a) Visual presentation will be marked for:

- -accuracy of description of central problem and four main events
- -colour
- -neatness
- -originality of pictures
- -overall design quality
- -neatness of lettering or writing

(b) Questions will be marked for:

- -the extent to which they cover the entire novel
- -their variety
- -their appropriateness for year six/seven students
- -neatness
- -spelling
- -correctness of grammatical form

TWO RESPONSES ARE TO BE COMPLETED AND HANDED IN ON WEDNESDAY, MARCH 5

PARENT'S SIGNATURE: ________________________________

DATE: ________________________________

EXAMPLE 7

## USE YOUR KNOWLEDGE

1. Create a mural that is linked by a time line. The mural should focus on Canadian political development.

2. Create an imaginary diary entry for John A. MacDonald. The entry is for the day that he received the news that, although Canada had passed Confederation, all the Maritime provinces had rejected it.

3. Using a variety of sources, research to identify changes that occurred when your province joined Canada.

4. Identify examples which show that compromise and working for consensus have roots in Canada's past.

5. Develop a political biography of Confederation. Using a variety of sources, collect the names and activities of the people involved with Confederation.

6. Write a personal position paper in which you attempt to convince another group of the advantages of becoming Canada's eleventh province.

7. Create a news report to show the highlights of Indian/Native self-government.

8. The sharing of political power between the Government of Canada and the provinces creates the opportunity for disagreements between the governments. Interview the Member of Parliament and the member of the Legislative Assembly for your area to determine if they are aware of provincial/federal differences over powers and responsibilities.

developers would be Sanders & Sanders (1984), Teaching creativity through metaphor and Roukes (1982), Art Synectics.

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As has been stressed above, critical and creative reflection takes time. This time has to be available in concrete forms as well as in the intents of such core recommendations as those which allow for an adaptive component and for local curriculum development. Teachers cannot be expected to "cover" the same amount of material in less time and to foster critical and creative reflection while doing so.

An example of overlap which could be at least partially eliminated is the emphasis on the family in grade one curriculum guides in Social Studies, Science, Health and Language Arts. Integration of these would both allow year one teachers more time for Language Arts and be congruent with the way young children learn.

RECOMMENDATION 4: AN EXTENSIVE REVIEW OF ALL PRESENT OR FUTURE CURRICULUM GUIDES SHOULD BE UNDERTAKEN WITH THE SPECIFIC INTENT OF ELIMINATING OVERLAP AND REPETITION AND PARING CONTENT TO ITS MOST ESSENTIAL ELEMENTS.

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The approach to curriculum revision and development which outlines the important concepts to be developed in the field (See Hart, 1987 and Olesen, 1987) and allows for teacher choice amongst specified courses and activities in developing understanding of these concepts has potential for both fostering critical and creative thinking and eliminating the excessive amounts of time involved in "covering" an entire textbook or course of study where the course is structured as factual material to be presented.

RECOMMENDATION 5: CONCEPTUAL ANALYSIS OF EACH SUBJECT AREA SHOULD BE UNDERTAKEN AND "KEY CONCEPTS TO BE UNDERSTOOD" SPECIFIED AS PART OF EACH CURRICULUM GUIDE.

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Research in early childhood education continues to stress the integrative nature of perception and understanding during the years from three to eight and the difficulty young children have with grasping the boundaries between individual subject areas.

RECOMMENDATION 6: DEVELOPMENT OF ONE INTEGRATED CURRICULUM GUIDE FOR SCIENCE, SOCIAL STUDIES AND HEALTH SHOULD BE CONSIDERED FOR KINDERGARTE TO GRADE THREE AS AN ALTERNATIVE WAY TO ALLOW FOR THE NEW BALANCES OF TIME PRESENTED IN THE CORE POLICY PROPOSALS. (REDUCING LANGUAGE ARTS TIME HAS NOT BEEN SEEN AS "ACCEPTABLE" BY MANY TEACHERS AND PARENTS.)

## Curriculum Revision in the Core Subjects Areas

Language Arts. Language Arts in kindergarten to grade six and English in grades seven to twelve are crucial areas in the development of reasoning abilities. Because critical and creative thought are sustained by an understanding of the central place of reflection in the creation and refinement of knowledge, our students need continued evidence that they, too, are part of this process of knowledge construction and evaluation - mainly as apprentices now but also as the artists, writers, philosophers and scientists of the future. The emphasis upon "getting through" workbooks and readers has allowed teachers and students little time for creative thinking and critical reflection and has reinforced a view of students as passive learners.

The more school time that is spent reading commercially produced materials and completing commercially produced workbooks and exercises from textbooks, the less likelihood there is that children will become aware of the genuine connections between thought, speech and print or between the various activities and subject areas. Language Arts holds the greatest potential for combatting the received nature of much of school learning, i.e., for turning students into active critics and constructors of knowledge. Further to the recommendations of the Communication Across the Curriculum report (Gambell, 1986), curriculum revision in Kindergarten to Grade 6 Language Arts should focus to a much greater extent upon the theory, strategies and contents of whole language practices and downplay the use of commercial reading series and workbooks. "Whole language" is taken to mean a theory about how children best acquire all the skills and processes of language, namely, through meaningful and purposeful activities which integrate reading, writing, speaking and listening with each other and with other areas of the curriculum.

This change will necessitate fuller, more specific information for teachers than is now contained in the Language Arts' Curriculum guides for Divisions I and II. Such information should include: lists of children's literature appropriate for inclusion as reading material at each grade level; a bibliography of references for teachers including both theoretical and practical material; a checklist of skills to be developed at each level; evaluation and record-keeping strategies; suggestions for ways to structure time, to develop questions and responses to reading material; guides for teaching writing as a process; and possible formats for individual reading conferences. Literature selected for inclusion at each grade level should (in addition to having a higher degree of literary merit) reflect the diversity of life-styles, economic situations and interests of the student population and a sampling of all genre.

One focus for the critical thinking skills outlined in Appendix II would be a media unit. Language Arts and English curriculum guides should be revised to include a unit which explores television, film, contemporary music and newspapers as influential communicators and shapers of our society.

As was mentioned earlier, debating is also an excellent way to foster both critical and creative thinking. Debates integrate content from other subject areas such as health, social studies and science with language arts' communication and research skills.

Literature study is one of the best areas of the curriculum for building students' self understanding and their knowledge of others. As has been argued above and in Malikail and Stewart's Personal and Social Values and Skills (1987), moral knowledge is built from an understanding of people, their common needs and emotions and their interdependence. Because such understandings are equally necessary for critical reasoning in the emancipatory sense, every opportunity should be taken to analyze the ethical themes in good literature and to help develop the connections between these and the students' lives. While literature study is more than this, - this focus is a crucial one to critical thinking. Literature study should also continue to incorporate the analysis of vocabulary and the intents or meanings of statements and arguments such as those critical thinking skills provided in Appendix II. However, the analysis of meaning, conceptual clarification and understanding of fallacious arguments should not be incorporated into literature study in such a way as to destroy the aesthetic qualities of the work.

Writing is a form of communication which can be structured to incorporate all the higher order thinking skills. The potential of writing for the fostering of critical and creative thought cannot be overemphasized. In addition to what is referred to frequently as "creative writing" (practices such as assigning a topic which involves use of the imagination to produce a fictional work), journal writing is an excellent vehicle for critical reflection. By journal writing I intend a broader focus than keeping a log of the events of one's life. Rather, journal writing is a term for personal writing where the students are involved in thinking and expressing their ideas on any topic in any subject area. It is a process of creating awareness in the individual student of their own thought processes and their present level of understanding of substantive content or social issues. Journal writing can be used across subject areas to foster deeper thinking about the subject matter understudy. The author has used this approach successfully with students from grades three to seven and with adult learners. See the samples of student writing below in which students developed understanding of the topic "Changes in the Physical World" as part of a unit on endangered and extinct species. These samples show journal writing which was assigned prior to and during a unit on endangered and extinct species. (See Example 8)

For further guidance in developing curricula which include journal writing see When Children Think, Jacobs, G. (1970), which is a more complete examination of the relationships between journal writing as expressing ideas and creative and critical thinking.

RECOMMENDATIONS:

7. ENGLISH AND LANGUAGE ARTS CURRICULUM REVISION SHOULD INCORPORATE AN INCREASED FOCUS ON WHOLE LANGUAGE PRACTICES PARTICULARLY IN GRADES ONE TO SIX AN SHOULD INCLUDE FULL DEVELOPMENT OF THESE PRACTICES IN MODEL UNITS.

8. DEBATING SHOULD BE INCORPORATED INTO CURRICULUM GUIDES FROM GRADES 7 TO 12 ALONG WITH SPECIFIC INFORMATION TO AID TEACHERS IN UNDERSTANDING THE SKILLS, TECHNIQUES, AND ATTITUDES INVOLVED.

9. JOURNAL WRITING SHOULD BE CONSIDERED AN IMPORTANT PART OF COMMUNICATION ACROSS THE CURRICULUM AND OF LANGUAGE ARTS FROM YEAR TWO AND UP.

10. A MEDIA UNIT SHOULD BE INCLUDED IN LANGUAGE STUDY AT EACH LEVEL BEGINNING WITH GRADE 2. SUCH UNITS SHOULD INCORPORATE A FOCUS ON THE SKILLS LISTED IN APPENDIX II.

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**EXAMPLE 8**

I have learned quiet a bit in the Subject called Change. What causes change is very simple. Man. It's very easy, because when we started living on earth, we wented chemacils, cement, buildings etc. We also change the way animals live around us.

Lot's of things change and many of the things never change back. Witch is sad. I figure that Some of these things change. Extinction, Sex, animals, people, etc.

Many people wonder what causes extinction? Do we? or does the animal change by itself?. Well, I think that it's people and their ideas. Many people ruin the enviroment. Like, buildings, homes, etc. We Know that people try not to, but somestimes you've got to try harder.) We shoot animals for food, and fur to sell. Imagine a ~~wold~~ world with know money

Nov. 6

## Change

A rock can changes by wind. The wind blows down the rock. Another thing that changes is a human being. We mature, we grow. A plant also changes, it grows and it reproduces. A dead body can change too. It can rot or decay into nothing, but ashes. Another thing that changes are insects. They can reproduce and grow. Almost every thing changes, like a ~~pen~~ mountain, wind blows it down. Weather also changes, it can be cold one day and hot the other. A lake changes, it has differant things in it. One thing that doesn't is the sun.
I think

Nov. 19

## Change in the Physical World

Man changes nature very much. He endangers animals by pollution. ~~sh~~ and shooting them for

Social Studies. The understanding of evidence or how theories are justified in history is not interchangeable with that same focus of understanding in the social sciences more generally. Epistemologies for history, geography, sociology, psychology, philosophy and economics should be developed separately in social studies' curriculi, particularly beginning in grade seven (where students have the substantive background necessary to appreciate their unique features). By grade ten these fields should be treated as separate subjects. This must not be taken to mean that integrative aspects of social studies will not continue to be important: Nor should epistemological understandings cotradict the importance of focusing upon current social issues particularly those relevant to students' lives. What is intended here is that arguments in the social studies be clarified and strengthened by understanding of the standards for evidence in the fields which it encompasses.

In addition to development of individual epistemological frameworks for the fields encompassed by social studies, new social studies curriculum development should include a unit or units in ethics and moral philosophy beginning in year seven. Such units should (in addition to developing understanding of the major concepts and processes of argumentation in ethics and moral philosophy) show clearly how parts of the bases for evidence in the social sciences are built from ethical positions, that the social sciences cannot be value neutral. Students must come to understand that problem-solving in the social sciences can never be purely a technical matter but rather should be seen as attempts to resolve how people should live together and how events and technologies interact with the values and power structures within social systems to affect people's lives.

Curriculum development in history must attempt to develop understanding of the selectivity at work in knowledge construction in that field and avoid maintaining the narrow foci of history textbooks of the past. For example, traditionally, the history of North America has been considered to be largely a history of the white male explorers, statesmen and military leaders and the contexts and events which their histories encompassed. This view of history tended to diminish or ignore the roles played by minority groups, women, and the common folk of these same times. Recent curriculum revision in Division III social studies has moved in the direction being recommended here with their inclusion of portrayals of individuals and the problems they face in dealing with such social forces as unemployment. (See Example 9 from the pilot edition of Canada and the World Community). This inclusion of information about the people in a society in addition to its political leaders, scientists or famous artists is essential for fostering a critical perspective upon history. This is so particularly in a democracy where good citizenship involves seeing how social decisions made by those in positions of power often disproportionately affect the lives of those with little power or influence. Students must also come to the recognition that one is never totally without the power to shape one's life or the lives of others. For the study of history to foster critical thinking and encourage active participation in the political shaping of our country and its institutions, students must see their story within the history under study. This means Canadian history must include the histories of all its cultural groups and of all economic levels of our society. This should be the case beginning in year one social studies with its focus on the family. Portrayals of the family must not idealize the middle-class two parent family or neglect presentation of the real and (in many cases) dramatic problems that families living in poverty face. Even at 5 years of age, children recognize when their is no match between their own lives and what school curricula presents as "family life".

John of Cape Breton

John is a fifty year old auto worker who has been unemployed for most of the last ten years. He worked in a Toyota assembly plant in the nearby city of Sydney until it closed in 1974. Since then he has been unable to find a permanent job.

Last year, John, his wife and two children, aged fourteen and seven, lived on $7,000. What does the family eat? "A lot of hot dogs, bologna, and macaroni." John and his wife have almost no money to spend on themselves, but they make a special effort to get new things for the children. John stated, "We try for the kids because they get teased at school. I shop around every day for bargains. You know, it takes all day to shop when you're poor."

Lionel and Louise of Labrador

Lionel and Louise live with their six children in an Indian village called Sheshatshiun in central Labrador. Their ancestors lived there for centuries. Since 1980, though, the area has been used for fighter plane training missions. The noise frightened off all the game animals which were the chief way for the people to support themselves.

The family home is a small four room government built cabin with no insulation. It is heated by a wood stove which has scorched the nearby wall. The floor is linoleum, and the paint is peeling from the walls. The nearest water tap is a five minute walk away.

Lionel and Louise are very unhappy with their way of life. They do not have enough money to buy proper food and clothing for their children, and they see no way to improve matters. There are no jobs available in the area. Malnutrition, poor sanitation and alcohol abuse all cause serious health problems for the family.

Nick of Winnipeg

Nick is twenty-three years old and has no job. He left school as soon as he could because he was bored with it. Even while he attended, he did not pay attention and never learned to read properly.

When he left school at age sixteen, he got a job as a janitor. He was soon fired because he could not read and write well enough to fill in order supply forms. He had the same kind of problems working at a gas station, where he could not fill out credit card receipts or make change properly.

When Nick found himself unemployed, he started drinking. He soon became an alcoholic. A friend finally convinced him to attend Alcoholics Anonymous meetings, and to enrol in literacy classes to improve his reading skill.

Alice of Saskatoon

Alice is a twenty year old single mother with two boys, aged five and three. She dropped out of school in grade 9 because she was expecting a baby. She was married for two years, but she and her husband fought constantly, so she left him. He refuses to give her any money to help with the children's expenses.

The only jobs available to Alice are cleaning other people's homes and babysitting. These do not pay very well. She often cannot make enough money to pay for bus fare and a babysitter for her own children.

Alice's children are dressed in second-hand clothes because that is all Alice can afford. Kool-aid is on the table more often than milk because it is cheaper. Christmas is a sad time because there is no money for presents.

Rita of Vancouver

Rita, age seventy-six, lives in a tiny house in an older district in Vancouver. The yard is perfectly kept, but the paint is peeling off the fence, and a broken window is patched with cardboard.

Rita's husband died several years ago. They had no money saved, so her only income is the government pension. She has to spend it all on food and the medicine she needs. There is none left for repairing her house.

Rita's main entertainment is attending events at the local church. She walks the seven blocks even in the winter, because she cannot afford busfare. Her pleasure is partly spoiled by the embarassment of wearing the same clothes to church year after year. She has no money for new ones.

What does being poor mean? One person expressed it this way.

"Well, to me poverty means not being able to buy nutritious food, instead of spaghetti and potatoes with the occasional two pounds of hamburg. I don't go to the food bank because I don't want to take food from someone who may need it more than me.

Not having that all-important job to go to.

Not being able to buy even the cheapest clothes to put on my back.

Doing the laundry in the bath tub because I can't afford to go to the laundromat.

Making sure that I make my phone calls before I leave home. I can't afford to give the phone company any of my precious quarters.

Not being able to buy someone you know the odd cup of coffee.

Losing people you called friends because you're now a bum.

Having absolutely no sense of security and worrying about what will happen to your family if you get sick or die.

Feeling like dirt, now that I'm broke."

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RECOMMENDATIONS:

11. WHERE SOCIAL STUDIES IS DEVELOPED AS ONE SUBJECT, CURRICULUM DEVELOPERS MUST ATTEMPT TO FOSTER UNDERSTANDING OF THE UNIQUE FIELDS WHICH IT ENCOMPASSES THROUGH INCLUSION (BEGINNING IN GRADE SEVEN) OF SEPARATE EPISTEMOLOGICAL FRAMEWORKS FOR HISTORY, GEOGRAPHY, SOCIOLOGY, PSYCHOLOGY, PHILOSOPHY AND ECONOMICS. INTEGRATION OF SOCIAL STUDIES' UNDERSTANDINGS WITH OTHER FIELDS RELATED TO THE AREA OF CONCERN AND WITH CURRENT SOCIAL ISSUES AND STUDENTS' EXPERIENCES SHOULD CONTINUE TO BE DEVELOPED.

12. CURRICULUM REVISION IN SOCIAL STUDIES CURRICULA (BEGINNING IN GRADE 7) SHOULD BE UNDERTAKEN TO INCLUDE THE STUDY OF ETHICS AND MORAL PHILOSOPHY.

13. HISTORY CURRICULA AND TEXTBOOKS SHOULD PORTRAY THE LIVES AND INFLUENCES OF WOMAN, MINORITY GROUPS, AND PEOPLE AT ALL SOCIO-ECONOMIC LEVELS AND FROM ALL CULTURES AND NOT FOCUS SO EXCLUSIVELY ON THE HISTORIES OF THOSE WITH POLITICAL, SOCIAL OR ECONOMIC POWER.

14. THE THEORETICAL BASE ESTABLISHED BY OLESEN'S (1987) FRAMEWORK FOR SOCIAL STUDIES SHOULD BE CONSIDERED AS SUPPORTIVE OF CRITICAL AND CREATIVE THINKING.

Science. Epistemological understandings in the natural and physical sciences must include accurate portrayals of how scientists do science including the place of values, idiosyncratic methods and "messy" as opposed to strict, laboratory-controlled experimentation. The scientific method must be seen as larger, less exact and more inclusive than its ideal version. Science interacts with social and political systems and technologies and must be explicitly portrayed as shaped by these interactions. For a full development of the important relationships between science and technology see Reg Fleming's Technological Literacy (1987). The Science Council of Canada's (1984) study of science education is a good source for curriculum developers who wish to portray more accurately the relationships between science man and society.

Every attempt should be made through curriculum revision to encourage female students to see themselves as potential scientists and as presently capable of critical and creative thought in science. This can be done partly through the inclusion of more autobiographical and biographical material on women scientists and through broadening the range of analogies used in teaching science to encompass all of life's experiences.

Curriculum revision should include more use of the pedagogy of Kindergarten and the early grades in being activity - centred, using concrete materials and a discovery or inquiry approach to counteract the version of "science as residing in books" which is held by many students. Science must be seen as activities and processes and not simply as inert textbook knowledge. This would mean fuller more explicit development of lesson plans in science curricula to replace an over-reliance on the textbook and to reinforce students' feelings of competence in the study of science. Such lesson plans need to include an emphasis on the evaluation and justification aspects of scientific thinking. Critical thinking skills and abilities in science would include: recognizing factors that need to be controlled in an experiment; criticizing faulty experiments; recognizing and justifying assumptions; using more than one kind of evidence to support conclusions; understanding the difference between a problem, a hypothesis and a theory; understanding the place of description and explanation in scientific theorizing; analyzing a hypothesis in terms of the types of evidence needed to refute or support it; and, analysis of the connections between science, technology, and other social institutions. (See the discussion in R. Fleming's (1987) Technological Literacy, pp. 6-11 for a more specific account of the focus for this type of analysis.)

RECOMMENDATIONS:

15. CURRICULAR REVISION IN THE NATURAL AND PHYSICAL SCIENCES SHOULD INCLUDE THE EPISTEMOLOGICAL UNDERSTANDING OF WHAT WOULD CONSTITUTE ACCURATE PORTRAYAL OF THE METHODS OF SCIENCE AND OF ITS RELATIONSHIP TO THE SOCIAL, POLITICAL, ECONOMIC AND TECHNICAL REALITIES OF THE TIME IN QUESTION.

    15.a This revision should include exploration of values, responsibilities and influences reflected or implicated in scientific research including ways to explore the concept of risk as it applies to scientific and technological research and to the role of the experts in our society.

16. CURRICULUM DEVELOPERS SHOULD DO AS MUCH AS POSSIBLE TO ENCOURAGE THE MORE ACTIVE PARTICIPATION OF FEMALE STUDENTS THROUGH THE INCLUSION OF A WIDER RANGE OF ANALOGIES AND BIOGRAPHICAL MATERIAL ON WOMAN IN THE SCIENCES.

17. CURRICULUM DEVELOPMENT IN THE SCIENCES SHOULD MAKE USE OF THE "SUMMARY OF FRAMEWORK FOR SCIENCE CURRICULUM". (Hart, 1987) AS A MODEL WHICH INCORPORATES AN EPISTEMOLOGICAL EMPHASIS AND INTEGRATION OF CRITICAL AND CREATIVE THINKING PROCESSES.

Other Core Subjects. Critical and creative thinking involve searching for the truth and meaning of life situations. School knowledge should be seen as a life situation that requires questioning and reasoning over passive acceptance. As was suggested earlier, a conceptual approach to school curriculi is one which demands understanding over memorization and continuous refinement over static acceptance. Just as concepts are dynamic; changing with new knowledge discoveries in a field, or with changing cultural values and social beliefs, the process of coming to understand them must be continuous. The concept of freedom, for example is worth examining at any age but should make more demands upon the thinking of grade 12 students than of those in grade three.

The approach being recommended here is one of looking at curriculum development which supports creative and critical thinking in terms of organizing curriculum guides in each subject area around key concepts. Factual knowledge remains equally important with this approach but is part of a purposeful and integrated system. One learns facts in order to understand the crucial concepts of a field and/or those personally meaningful to you as an individual with unique interests and abilities, or as a member of a society and a culture. Many key concepts will seem intrinsically meaningful on all three criteria and relate to more than one subject area (e.g.) time, space. Conceptual knowledge (based on the best factual knowledge available) supports the understanding of principles and leads to the understanding or active construction of theories. In the understanding of this paper's treatment of critical and creative thinking as interrelated and ethically-based, concepts crucial to the growth of critical and creative thought processes and underlying values can be set out.

In addition to the recommendations made above for the subject areas of English/Language Arts, Social Studies and Science, other core subject areas have a role to play in fostering critical and creative thought. The conceptual approach is particularly useful to discussion here.

Key areas for inclusion in new Health curriculi is the development of understanding of human needs and of rights and responsibilities based upon those needs. While this will include understanding of basic physical needs, an appreciation of the human need for love, acceptance and affirmation must also be incorporated. Health curriculi should include as key concepts egocentricity, reciprocity, altruism, identity, responsibility, respect, love, and friendship in addition to areas presently dealt with. Many of these will receive a somewhat different treatment in relation to healthy living than they would as concepts examined in Social Studies or Language Arts' literature study.

In physical education two concepts which need to be examined through discussions and thought-provoking activities are those of competition and cooperation. New insights into these concepts may be provided by their treatment in a physical education setting which would not surface in a social studies or economics class. Physical education curriculi should also incorporate examination of the concepts of rules and fairness.

Mathematics is a subject area which can provide for a little or a lot of critical and creative thinking depending upon the way it is taught. See Hope's (1987) discussion of our society's requirements for numeracy and a pedagogical emphasis supportive of these requirements as a background to understanding how one might foster growth of critical and creative thinking in mathematics. Key concepts to be examined in mathematics include those of proof, probability and risk.

The recently developed program objectives for Dance, Drama, Music and the Visual Arts (Saskatchewan Education, 1987) contain a strong focus on critical and creative thinking processes, values and attitudes. Amongst the concepts given prominence in this framework are those of history and culture as they relate to the arts. As part of the critical/responsive component in this framework, the concepts related to Aesthetics through creating understanding of criticism and the role of the critic in the arts should be specified. Material should also be included in the curriculum guides which would help teachers clarify their understanding of these concepts as well as that directed towards students.

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## Recommendations relating to the roles of the Department of Education, the Saskatchewan Trustees Association and the Universities in fostering critical and creative thought

Saskatchewan Education has a leadership role to play in the fostering of critical and creative thought in a number of key areas. Beyond their more obvious role of overseeing curriculum revision and teacher in-service resulting from the incorporation of critical and creative thinking as common essential learnings, the provincial department of education needs to provide forceful leadership in the development of guidelines for the selection, training and evaluation of educational administrators. A united effort on the part of the Colleges of Education (particularly their Departments of Educational Administration), the Saskatchewan Trustees Association, and the Saskatchewan Teachers Federation, and spearheaded by Saskatchewan Education, to develop a comprehensive policy on educational leaders (including a code of ethics for educational administrators) is crucial. We must find ways to recognize the differences between educational administrators with dogmatic, uncritical and self-serving tendencies and those individuals who exhibit fair-mindedness, critical and creative thinking abilities and genuine compassion for the people they serve and direct. It is important that all the departments and associations mentioned above have input into the development of such a policy and into in-service packages for trustees and administrators designed to create the understandings set out above. Critical thinking in the emancipatory sense is such an important complex of abilities and values for educational administrators to possess that it needs to be made one explicit focus of the Educational Leadership program being developed by the University of Saskatchewan, Department of Educational Administration.

The departments of Curriculum Studies of the two campuses should be involved in curriculum revision and in the course revision necessary to provide education students with understanding of the methods, contents and values of critical pedagogy. Our two Colleges of Education, together with the Saskatchewan Teachers Federation needs to look at the revision of their internship supervision manual to change its present emphasis upon teacher directed lessons using the lecture method and its lack of congruence with activity-centred or discussion-oriented approaches.

Saskatchewan Education together with the Saskatchewan Teachers Federation will need to look at developing a comprehensive policy for the supervision of teachers - one which incorporates the assessment of their teaching as it relates to all of the Common Essential Learnings. Saskatchewan Education should also play a leadership role in the development of a new policy on student evaluation which incorporates all of the Common Essential Learnings as well as curriculum revision which includes assessment of students' abilities to think critically and creatively within each subject area.

RECOMMENDATIONS:

18. SASKATCHEWAN EDUCATION MUST TAKE A LEADING ROLE IN THE DEVELOPMENT OF A POLICY ON THE SELECTION, TRAINING AND EVALUATION OF EDUCATIONAL ADMINISTRATORS. SUCH A POLICY MUST INCORPORATE UNDERSTANDING OF THE IMPORTANCE OF EMANCIPATORY CRITICAL THINKING TO EDUCATIONAL LEADERSHIP.

19. THE EDUCATIONAL LEADERSHIP PROGRAM DEVELOPED BY THE DEPARTMENT OF EDUCATIONAL ADMINISTRATION, UNIVERSITY OF SASKATCHEWAN SHOULD INCLUDE A COMPULSORY HALF-CLASS IN CRITICAL THINKING AND ITS IMPLICATIONS FOR EDUCATIONAL LEADERSHIP.

20. CURRICULUM AND COURSE REVISION MUST BE UNDERTAKEN BY COLLEGES OF EDUCATION IN ORDER TO PROVIDE TEACHERS AND EDUCATION STUDENTS WITH UNDERSTANDING OF THE CONTENTS AND METHODS OF CRITICAL PEDAGOGY AND CREATIVE PROCESSES AND THEIR EVALUATION.

21. THE INTERNSHIP SUPERVISION MANUAL SHOULD BE REVISED TO INCORPORATE A BROADER VISION OF PEDAGOGY THAN IS NOW THE CASE-INCLUDING PRACTICES MORE SUPPORTIVE OF CRITICAL AND CREATIVE THINKING THAN PREDOMINATELY TEACHER-DIRECTED METHODS. THIS

REVISION COULD BE THE JOINT RESPONSIBILITIES OF THE SASKATCHEWAN TEACHERS FEDERATION AND THE TWO COLLEGES OF EDUCATION.

22. THE SASKATCHEWAN TEACHERS FEDERATION NEEDS TO TAKE THE LEADERSHIP IN DEVELOPING A NEW POLICY AND GUIDELINES FOR TEACHER SUPERVISION IN LINE WITH THE CRITICAL AND CREATIVE THINKING PRACTICES BEING RECOMMENDED HERE TOGETHER WITH THOSE FROM THE INCORPORATION OF THE OTHER COMMON ESSENTIAL LEARNINGS.

### Scope and sequence of creative and critical thinking processes, abilities and skills: issues, concerns, and possibilities for curriculum revision

Creative and critical thought processes, values, abilities and skills are dependent upon the particular subject matter of interest for their specific character. Therefore, they must be developed separately in each of the core subjects and electives. While creative reflection is an especially open-ended task, critical-thinking borrows some of its form from logic and ethics and can be delineated partially as general skills and abilities. These general skills and abilities are shown in Table 4. They must be developed further, however, by curriculum writers in each of the subject areas.

As a foundational set of values and abilities, curriculum developers should look to Malikail & Stewart's Personal and Social Values and Skills. Their scope and sequence chart should be considered equally applicable to the development of critical thinking. (Critical thinking being strengthened by self knowledge and knowledge of the feelings of others and of values such as fairness, truth, compassion, etc.)

Beyond this, the set of skills and abilities which follow are important to critical thinking and should be incorporated into specific questions, assignments and activities by curriculum revision in each of the subject areas. Table 4 shows the scope of general skills and abilities and a very broad sequencing which shows which of these could be introduced in primary, elementary and middle levels. All skills and abilities are considered essential and once introduced should continue to be developed right through to end of Grade 12. Separation into levels was done with incomplete knowledge of child development, optional learning sequences and actual degree of difficulty of each skill or ability and should be used as suggestions only.

## TABLE 4

### Scope and Sequence of Critical Thought Processes, Skills and Abilities

| Introduce | |
|---|---|
| **Primary** (Kindergarten to Grade 3) | 1. Understanding human needS |
| | 2. understanding human rights |
| | 3. fostering independent thinking |
| | 4. recognizing the need for specific information |
| | 5. developing criteria for evaluation |
| **Elementary** (Grades 4 to 6) | 6. developing insight into egocentricity |
| | 7. fostering reciprocity |
| | 8. clarifying one's own motives |
| | 9. developing insight into the motives of others |
| | 10. recognizing a need for a knowledge base in the area in question |
| | 11. exploring thoughts underlying feelings |
| | 12. exploring underlying purposes |
| | 13. recognizing reasons underlying categories |
| | 14. discouraging stereotyping |
| | 15. distinguishing facts from ideals |
| | 16. clarifying issues |
| | 17. clarifying ideas |
| | 18. distinguishing ideas |
| | 19. distinguishing relevant from irrelevant facts |
| | 20. making inferences |
| | 21. supplying evidence for a conclusion |
| | 22. evaluating source credibility |
| | 23. evaluating solutions |
| | 24. evaluating actions |
| | 25. evaluating motives |
| **Middle** (Grades 7 to 9) | 26. integrating critical vocab. |
| | 27. making assumptions explicit |
| | 28. recognizing contradictions |
| | 29. critiquing text |
| | 30. exploring implications |
| | 31. using probability qualifiers |
| | 32. evaluating assumptions |
| | 33. evaluating arguments |
| | 34. exploring the concept of "risk" as it relates to issues |

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# APPENDIX I

FROM: Essays on the Intellect (Walter, J. and Gardner M. in Link, F. 1985)

## Musical Intelligence

When he was three years old, Yehudi Menuhin was smuggled into the San Francisco Orchestra concerts by his parents. The sound of Louis Persinger's violin so entranced the youngster that he insisted on a violin for his birthday and Louis Persinger as his teacher. He got both. By the time he was ten years old, Menuhin was an international performer (Menuhin, 1977).

Violinist Yehudi Menuhin's Musical Intelligence manifested itself even before he had touched a violin or received any musical training. His powerful reaction to that particular sound and his rapid progress on the instrument suggest that he was biologically prepared in some way for that endeavour. In this way evidence from child prodigies supports our claim that there is a biological link to a particular Intelligence. Other special populations, such as autistic children who can play a musical instrument beautifully but who cannot speak, underscore the independence of Musical Intelligence.

A brief consideration of the evidence suggests that musical skill passes the other tests for an Intelligence. For example, certain parts of the brain play important roles in perception and production of music. These areas are characteristically located in the right hemisphere, although musical skill is not as clearly "localized", or located in specifiable area, as language. Although the particular susceptibility of musical ability to brain damage depends on the degree of training and other individual differences, there is clear evidence for "amusia" or loss of musical ability.

Music apparently played an important unifying role in Stone Age societies. Birdsong provides a link to other species. evidence from various cultures supports the notion that music is a universal faculty. Studies of infant development suggest that there is a "raw" computational ability in early childhood. Finally, music notation provides an accessible and lucid symbol system.

In short, evidence to support the interpretation of musical ability as an "Intelligence" comes from many different sources. Even though musical skill in not typically considered an intellectual skill like mathematics, it qualifies under our criteria. By definition it deserves consideration; and in view of the data, its inclusion is empirically justified.

## Bodily-Kinesthetic Intelligence

Fifteen year old Babe Ruth played third base. During one game his team's pitcher was doing very poorly and Babe loudly criticized him from third base. Brother Mathias, the coach, called out, "Ruth, if you know so much about it, YOU pitch!" Babe was surprised and embarrassed because he had never pitched before, but Brother Mathias insisted. Ruth said later that at the very moment he took the pitcher's mound, he KNEW he was supposed to be a pitcher and that it was "natural" for him to strike people out. Indeed, he went on to become a great major league pitcher (and, or course, legendary status as a hitter)(Connor, 1982).

Like Menuhin Babe Ruth was a child prodigy who recognized his "instrument" immediately upon is first exposure to it. This recognition occurred in advance of formal training.

Control of bodily movement is, of course, localized in the motor cortex, with each hemisphere dominant or controlling bodily movements on the contralateral side. In right-handers, the dominance for such movement is ordinarily found in the left hemisphere. The ability to perform movements when directed to do so can be impaired even in individuals who can perform the same movements reflexively or on a nonvoluntary basis. The existence of specific apraxia constitutes one line of evidence for a Bodily-Kinesthetic Intelligence.

The evolution of specialized body movements is obvious advantage to the species, and in humans this adaptation is extended through the use of tools. Body movement undergoes a clearly defined developmental schedule in children. And there is little question of its universality across cultures. Thus it appears that bodily-kinesthetic "knowledge" satisfies many of the criteria for an Intelligence.

Perhaps more difficult, however, is the consideration of bodily-kinesthetic knowledge as "problem solving". Certainly carrying out a mime sequence or hitting a tennis ball is not solving a mathematical equation. And yet, the ability to use one's body to express an emotion (as in a dance), to play a game (as in a sport) or to create a new product (as in devising an invention) are evidence of he cognitive features of body usage. The specific computations required to solve a particular bodily-kinesthetic problem, hitting a tennis ball, are summarized by Tim Gallwey:

> At the moment the ball leaves the server's racket, the brain calculates approximately where it will land and where the racket will intercept it. This calculation includes the initial velocity of the ball, combined with an input for the progressive decrease in velocity and the affect of wind and after the bounce of the ball. Simultaneously, muscle orders are given; not just once, but constantly with refined and updated information. The muscles must cooperate. A movement of the feet occurs, the racket is taken back, the face of the racket kept at a constant angle. Contact is made at a precise point that depends on whether the order was given to hit down the line or cross-court, an order not given until after a split-second analysis of the movement and balance of the opponent.
>
> To return an average serve, you have about one second to do this. To hit the ball at all is remarkable and yet not uncommon. The truth is that everyone who inhabits a human body possesses a remarkable creation (Gallwey,1976).

## Logical-Mathematical Intelligence

In 1983 Barbara McClintock won the Nobel Prize in Medicine or Physiology for her work in microbiology. Her intellectual powers of deduction and observation illustrate one form of Logical-Mathematical Intelligence that is often labeled "scientific thinking". One incident is particularly illuminating. While a researcher at Cornell in the 1920's McClintock was faced one day with a problem: while theory predicted 50 percent pollen sterility in corn, her research assistant (in the "field") was finding plants that were only 25 to 30 percent sterile. Disturbed by this discrepancy, McClintock left the cornfield and returned to her office where she sat for half an hour, thinking:

> Suddenly I jumped up and ran back to the (corn) field. At the top of the field (the others were still at the bottom) I shouted "Eureka, I have it! I know what the 30% sterility is!...They asked me to prove it. I sat down with a paper bag and a pencil and I started from scratch, which I had not done at all in my laboratory. It had all been done so fast; the answer came and I ran. Now I worked it out step by step - it was an intricate series of steps - and I cam out

with (the same result). (They) looked at the material and it was exactly as I'd said it was; it worked out exactly as I had diagrammed it. Now, why did I know, without having done it on paper? Why was I so sure? (Keller, 1982, p.104).

This anecdote illustrates two essential facts of the Logical-Mathematical Intelligence. First, in the gifted individual, the process of problem solving is often remarkable rapid - the successful scientist copes with many variables at once and creates numerous hypotheses that are each evaluated and then accepted or rejected in turn.

The anecdote also underscores the nonverbal nature of the Intelligence. A solution to a problem can be constructed before it is articulated. In fact, the solution process may be totally invisible, even to the problem solver. This need not imply, however, that discoveries of this sort - the familiar "Aha"! phenomenon - are mysterious, intuitive, or unpredictable. The fact that it happens more frequently to some people (perhaps Nobel Prize winners) suggests the opposite. We interpret this as the work of the Logical-Mathematical Intelligence.

Along with the companion skill of language, logical-mathematical reasoning provides the basis for IQ tests. This form of Intelligence has been heavily investigated by traditional psychologists, and it is the archetype of "raw intelligence" or the problem-solving faculty that purportedly cuts across domains. It is perhaps ironic, then, that the actual mechanism by which one arrives at a solution to a logical-mathematical problem is not as yet properly understood.

This Intelligence is supported by our empirical criteria as well. Certain areas of the brain are more prominent in mathematical calculation than others. There are idiots savants who perform great feats of calculation even though they remain tragically deficient in most other areas. Child prodigies in mathematics abound. The development of this Intelligence in children has been carefully documented by Piaget and other psychologists.

## Linguistic Intelligence

At the age of ten, T.S. Eliot created a magazine called "Fireside" to which he was the sole contributor. In a three day period during his winter vacation, he created eight complete issues. Each one included poems, adventure stories, a gossip column, and humour. Some of this material survives and it displays the talent of the poet (see Soldo, 1982).

As with the Logical Intelligence, calling linguistic skill an "Intelligence" is consistent with the stance of traditional psychology, Linguistic Intelligence also passes our empirical tests. For instances, a specific area of the brain, called "Broca's Area", is responsible for the production of grammatical sentences. A person with damage to this area can understand words and sentences quite well but has difficulty putting them together in anything other than the simplest of sentences. At the same time, other thought processes may be entirely unaffected.

The gift of language is universal, and its development in children is strikingly constant across cultures. Even in deaf populations where a manual sign language is not explicitly taught, children will often "invent" their own manual language and use it surreptitiously! We thus see how an Intelligence may operate independently of a specific input modality or output channel.

## Spatial Intelligence

Navigation around the Caroline Islands in the South Seas is accomplished without instruments. The position of the stars, as viewed from various islands. the weather patterns, and water color are the only sign posts. Each journey is broken into a series of segments; and the navigator learns the position of the stars within each of these segments. During the actual trip the navigator must envision mentally a reference island as it passes under a particular star and from that he computes the number of segments completed, the proportion of the trip remaining, and any corrections in heading that are required. The navigator cannot see the islands as he sails along; instead he maps their locations in his mental "picture" of the journey (Gardner, 1983).

Spatial problem solving is required for navigation and in the use of the notational system of maps. Other kinds of spatial problem solving are brought to bear in visualizing an object seen from a different angle and in playing chess. The visual arts also employ this Intelligence in the use of space.

Evidence from brain research is clear and persuasive. Just as the left hemisphere has, over the course of evolution, been selected as the site of linguistic processing, the right hemisphere proves to be the site most crucial for spatial processing. Damage to the right posterior regions causes impairment of the ability to find one's way around a site, to recognize fears or senses, or to notice fine details.

Patients with damage specific to regions of the right hemisphere will attempt to compensate for their spatial deficits with linguistic strategies. They will try to reason aloud, to challenge the task, or even make up answers. But such nonspatial strategies are rarely successful.

Blind populations provide an illustration of the distinction between the Spatial Intelligence and visual perception. A blind person can recognize shapes by an indirect method: running a hand along the object translates into length of time of movement, which in turn is translated into the size of the object. For the blind person, the perceptual system of the tactile modality parallels the visual modality in the seeing person. The analogy between the spatial reasoning of the blind and the linguistic reasoning of the deaf is notable.

There are few child prodigies among visual artists, but there are idiots savants such as Nadia (Selfe, 1977). Despite a condition of severe autism, this preschool child made drawings of the most remarkable representational accuracy and finesse.

## Interpersonal Intelligence

With little formal training in special education and nearly blind herself, Anne Sullivan began the intimidating task of instructing a blind and deaf seven year old Helen Keller. Sullivan's efforts at communication were complicated by the child's emotional struggle with the world around her. At their first meal together, this scene occurred:

> Anne did not allow Helen to put her hand into Annie's plate and take what she wanted, as she had been accustomed to do with her family. It became a test of wills - hand thrust into plate, hand firmly put aside. The family, much upset, left the dining room. Annie locked the door and proceeded to ear her breakfast while Helen lay on the floor kicking and screaming, pushing and pulling at Annie's chair. [After half an hour] Helen went around the table looking for her family. She discovered no one else was there and that bewildered her. Finally, she sat down and began to eat her breakfast, but with her hands. Annie gave her a spoon. Down on the floor it clattered, and the contest of wills began anew (Lash, 1980, p. 52).

Anne Sullivan sensitively responded to the child's behavior. She wrote home: "The greatest problem I shall have to solve is how to discipline and control her without breaking her spirit. I shall go rather slowly at first and try to win her love."

In fact, the first "miracle" occurred two weeks later, well before the famous incident at the pumphouse. Annie had taken Helen to a small cottage near the family's house, where they could live alone. After seven days together, Helen's personality suddenly underwent a profound change - the therapy had worked:

> My heart is singing with joy this morning. A miracle happened! The wild creature of two weeks ago has been transformed into a gentle child (p. 54).

It was just two weeks after this that the first breakthrough in Helen's grasp of language occurred; and from that point on, she progressed with incredible speed. The key to the miracle of language was Anne Sullivan's insight into the person of Helen Keller.

Interpersonal Intelligence builds on a core capacity to notice distinctions among others; in particular, contrasts in their moods, temperaments, motivations, and intentions. In more advanced forms, this Intelligence permits a skilled adult to read the intentions and desires of others, even when these have been hidden. This skill appears in a highly sophisticated form in religious or political leaders, teachers, therapists, and parents. The Helen Keller-Anne Sullivan story suggests that this Interpersonal Intelligence does not depend on language.

All indices in brain research suggest that the frontal lobes play a prominent role in interpersonal knowledge. Damage in this area can cause profound personality changes while leaving other forms of problem solving unharmed - a person is often "not the same person" after such an injury.

Alzheimer's disease, a form of presenile dementia, appears to attack posterior brain zones with a special ferocity, leaving spatial, logical, and linguistic computations severely impaired. Yet, Alzheimer patients will often remain well groomed, socially proper, and continually apologetic for their errors. In contrast, Pick's disease, another variety of presenile dementia that is more frontally oriented, creates a rapid loss of social graces.

Biological evidence for Interpersonal Intelligence encompasses two additional factors often cited as unique to humans. One factor is the prolonged childhood of primates, including the close attachment to the mother. In those cases where the mother is removed from early development, normal interpersonal development is in serious jeopardy. The second factor is the relative importance in humans of social interaction. Skills such as hunting, tracking, and killing in prehistoric societies required participation and cooperation of large numbers of people. The need for group cohesion, leadership, organization, and solidarity follows naturally from this.

## Intrapersonal Intelligence

In an essay called "A Sketch of the Past", written almost as a diary entry, Virginia Woolf discusses the "cotton wool of existence"-the various mundane events of life. She contrasts this "cotton wool" with three specific and poignant memories from her childhood: a fight with her brother, seeing a particular flower in the garden, and hearing of the suicide of a past visitor:

There are three instances of exceptional moments. I often tell them over, or rather they come to the surface unexpectedly. But now for the first time I have written them down, and I realize something that I have never realized

> before. Two of these moments ended in a state of despair. The other ended, on the contrary, in a state of satisfaction.
>
> The sense of horror (in hearing of the suicide) held me powerless. But in the case of the flower, I found a reason; and was thus able to deal with the sensation. I was not powerless.
>
> Though I still have the peculiarity that I receive these sudden shocks, they are now always welcome; after the first surprise, I always feel instantly that they are particularly valuable. And so I go on to suppose that the shock receiving capacity is what makes me a writer. I hazard the explanation that a shock is at once in my case followed by the desire to explain it. I feel that I have had a blow; but it is not, as I thought as a child, simply a blow from an enemy hidden behind the cotton wool of daily life; it is or will become a revelation of some order; it is a token of some real thing behind appearances; and I make it real by putting it into words (Woolf, 1976, pp. 67-70).

This quotation vividly illustrates the Intrapersonal Intelligence-knowledge of the internal aspects of a person: access to one's own feeling life, one's range of emotions, the capacity to effect discriminations among these emotions and eventually to label them and to draw upon them as a means of understanding and guiding one's own behavior. Since this Intelligence is the most private, it requires evidence from language, music, or some other more expressive form of Intelligence if the observer is to detect it at work. In the above quotation, for example, Linguistic Intelligence is drawn upon to convey intrapersonal knowledge; it embodies the interaction of Intelligences, a common phenomenon to which we will return later.

We see the familiar criteria at work in the Intrapersonal Intelligence. As with the Interpersonal Intelligence, the frontal lobes play a central role in personality change. Injury to the lower area of the frontal lobes is likely to produce irritability or euphoria; while injury to the higher regions is more likely to produce indifference, listlessness, slowness, and apathy - a kind of depressive personality. In such "frontal-lobe" individuals, the other cognitive functions often remain preserved. In contrast, among aphasics who have recovered sufficiently to describe their experiences, we find consistent testimony: while there may have been a diminution of general alertness and considerable depression about the condition, the individual in no way felt himself to be a different person. He recognized his own needs, wants, and desires and tried as best he could to achieve them.

The autistic child is a prototypical example of an individual with impaired Intrapersonal Intelligence; indeed, the child may not even be able to refer to himself. At the same time, such children often exhibit remarkable abilities in the musical, computational, spatial, or mechanical realms.

Evolutionary evidence for an Interpersonal faculty is more difficult to come by, but we might speculate that the capacity to transcend the satisfaction of instinctual drives is relevant. This becomes increasingly important in a species not perennially involved in the struggle for survival.

In sum, then, both Interpersonal and Intrapersonal faculties pass the tests of an Intelligence. They both feature problem-solving endeavors with significance for the individual and the species. In the individual's sense of self, one encounters a melding of inter- and intra-personal components. Indeed, the sense of self emerges as one of the most marvelous of human inventions - a symbol that represents all kinds of information about a person and which is at the same time an invention that all individuals construct for themselves.

# APPENDIX II

FROM: The Teaching of Critical Thinking (D'Angelo 1971)

Critical thinking consists of various kinds of linguistic, logical, empirical, methodological, and valuational skills. Among these skills are:

(1) Determining the meaning of a term or a statement. We cannot discuss an issue intelligently unless there is some agreement about the meaning of the words we use. Since words have many meanings, it is imperative to determine the specific meaning of word or statement, e.g., force.

(2) Recognizing ambiguities. A word is ambiguous when it has more the one meaning and it is not clear which meaning is intended within a particular context, e.g., do you believe in freedom? The word "freedom" has many meanings and it is unclear which meaning is being used in this question. Sentences can also be ambiguous, e.g., Wanted: man to drill holes on the fifth floor. Is the man wanted to drill holes in the floor or will he work on the fifth floor.

(3) Defining key terms. It is important to define terms in order to communicate ideas clearly. Many disputes can be resolved, if we define our terms prior to inquiries. William James tells a story of two groups of men who argued whether a squirrel was going around a tree, without realizing they were using different definitions of the term "around". We use various kinds of definitions in our inquiries. They include reportive, stipulative, analytic and operational definitions.

(4) The analysis of emotional language. Emotive language refers to words that are used to arouse or express feelings of approval or disapproval. Words such as "flatfoot" and "lush" are emotive terms. An uncritical acceptance of an emotive term can lead to prejudging a person or a situation and to distorting a particular referent.

(5) Avoiding vague terms. Some terms in our language are vague, i.e., they have no clear and definite referent. Terms like "free", "manly", "many", "some", and "most" are vague, e.g., there were many hippies in the riot. How many individuals does the word "many" refer to?

(6) Interpreting words with regard to context. What does the word "pass" mean? One cannot answer this question unless he observes the context in which the word is used. Words or expressions that are quoted out of context can also be misleading. It was stated in a review of a book that it was a good book for teachers only. The author quoted as saying "it was a good book."

(7) Avoiding slanting judgments. Slanting is the process of selecting certain facts and avoiding other pertinent facts in judging a person or an event, e.g., John dislikes dogs and cats. What kind of a person is John?

(8) The analysis of cliches. Cliches are expressions in the form of proverbs, maxims, and quotations, e.g., he who hesitates is lost; like father, like son. These statements are oversimplifications. In some

situations, he who hesitates is lost, but in others it is better to hesitate and carefully consider the numerous consequences of an action.

(9) The realization that the word is not the thing. There is no necessary connection between the symbol (picture or word) and that which is symbolized (thing). It used to be obligatory to rescue the emperor's picture in Japan, if a schoolhouse was on fire. It is erroneous to believe that if the emperor's picture burned, the emperor would burn. Burning the American flag will not destroy the United States.

(10) Distinguishing between denotation and connotation. The denotation of a word refers to its referent in the physical world, whereas the connotation refers to the words we use in establishing its meaning. The word "table" refers to the physical entity in its denotative meaning, and the connotative meaning refers to all the meanings we attribute to a table. Some words like "elf" have a connotation, but no denotation.

(11) Avoid mistaking figurative language for literal language. Some words are used figuratively and are not to be taken literally, e.g., Johnny is a bastard. If taken literally, this means Johnny is an illegitimate child. However, in a figurative sense one is merely reacting in an emotional manner towards Johnny.

(12) Recognizing the etymological fallacy. This fallacy is committed when it is maintained that the best method for determining the meaning of a word is to discover how it was originally used. The etymological derivation of the word "sophomore" indicates that it means a wise fool. To maintain that this is the real meaning of "sophomore" is to ignore the fact that the meaning of a word changes in time, and that the context also plays a part in ascertaining its meaning.

(13) Giving concrete meaning to abstract terms. The referent of an abstract term is sometimes unclear. What does the word "justice" mean? If one defines justice in terms of equality, then we have defined one abstract term by using another abstract term. What is needed is a concrete term or a set of relations that operationally define an abstract term, e.g., justice is the act of granting the same rights to everyone regardless of race, colour, creed, economic status, or social position.

(14) Recognizing and justifying assumptions. An assumption is a belief that is taken for granted in the course of an argument, in our behaviors, and in the system of beliefs we possess, e.g., when we sit into a chair, we assume that it will hold our weight. Empirical evidence and valid arguments are some means of justifying assumptions.

(15) Judging whether statements contradict each other. Two statements contradict each other if one is the denial of the other, e.g., John is married and John is not married. If two statements contradict each other, they both cannot be true.

(16) Recognizing the fallacy of the irrelevant conclusion. This fallacy is committed when irrelevant facts are used to prove a point at issue. In attempting to prove that Mr. Smith murdered Mr. Jones, the prosecuting attorney may argue that the murder is a horrible crime. This conclusion is irrelevant to the issue, i.e., Did Mr. Smith murder Mr. Jones?

(17) Recognizing the fallacy of arguing against the man. This fallacy is based on the assumption that a statement that discredits a mean, discredits his argument. A man may be a criminal and still present a valid argument when discussing an issue such as the merits of socialized medicine. It would be fallacious to argue that his views on socialized medicine are unsound, since he is a criminal.

(18) Recognizing the fallacy of appealing to force. This fallacy involves the use of force or the threat of force as a means of getting someone to accept a particular conclusion. Arguments that utilize the idea that "might makes right" commit this fallacy, e.g., the army was justified in taking over the village, since it has a more powerful force than any other group.

(19) Recognizing the fallacy of arguing ignorance. This fallacy is committed when one argues that a certain statement is true simply because it has not been proven false, e.g., it is true that flying saucers are interplanetary space ships, since this belief has not been proven false. Ignorance cannot be the basis for verifying beliefs.

(20) Recognizing the fallacy of appealing to the sentiments. This fallacy involves the use of pity and other feelings as a means of getting a particular conclusion accepted, e.g., he could not have committed the crime, since he has a wife, three children, and a brilliant military record.

(21) Recognizing the fallacy of appealing to the multitude. This fallacy is committed when one appeals to the practice of the multitude in order to justify an argument. Advertisers often use this types of argument when they claim that a certain product should be purchased, since it is used by most people, e.g., be like most successful people and smoke Logo cigarettes.

(22) Recognizing the fallacy of composition. What is true of the part is not necessarily true of the whole, e.g., every member of this team is an outstanding player, therefore the entire team is outstanding. This does not necessarily follow, since the players may not play well together.

(23) Recognizing the fallacy of division. What is true of the whole, is not necessarily true of any one of its parts. The fact that the United States is a wealthy nation does not mean that Mr. Jones, a United States citizen, is wealthy.

(24) Recognizing the fallacy of extension. This fallacy involves the extension of an opponent's position to an extreme that will be found to be unacceptable, e.g., in arguing whether to allow a child a certain freedom for the child.

(25) Recognizing the fallacy of prejudicing the issue. This fallacy involves labeling a position prior to inquiry, when there is little or no evidence to justify this label, e.g., you cannot expect student rebels to respect the law, since they are anarchists. The "anarchists" is judicial to a proper evaluation of the behavior of student rebels.

(26) Recognizing the black or white fallacy. This fallacy is committed when we assume that in a given situation there are only two alternatives when actually there are more than two, e.g., you must tell the truth or lie.

(27) Recognizing equivocations. We are equivocating when the same term is used in different ways within a particular argument. This is a form of fallacious reasoning. An example of an equivocation would be the use of the word "spirit" in the following argument: the spirit of God can be seen in the spirit of the Marine Corps.

(28) Recognizing the fallacy of begging the question. This fallacy is committed when we accept in our conclusion the belief that we initially set out to prove, e.g., Why are you drinking? To forget. Forget what? To forget that I am ashamed. Ashamed of what? Ashamed that I am drinking.

(29) Recognizing the fallacy of the complex question. This fallacy is committed when a plurality of questions is asked within a statement or an argument, and a single answer is requested or returned to the complex question, e.g., Did you stop beating your wife? A straightforward "yes" or "non" answer cannot be given to this question. It assumes the individual has beaten his wife in the past.

(30) Recognizing hasty generalizations. Making a generalization about an entire class based on a few observations is a hasty generalization, e.g., we observe the two Irishmen in our neighborhood are alcoholics, and we conclude that all Irishmen are alcoholics.

(31) Recognizing the gambler's fallacy. Some people believe if a coin has been tossed 50 times and it has come out heads 45 times and tails 5 times, then in subsequent throws the coin will turn up tails more often than heads. This belief assumes that a coin has a memory and a "desire to catch up". There is always a 50-50 chance on each throw that a coin will turn up heads or tails.

(32) The false cause fallacy. This fallacy is committed when someone concludes that one event cause another solely on the basis of temporal proximity. The fact that A precedes B, does not mean that A is the cause of B. If sticking a pin in a doll of Mr. James preceded Mr. James bleeding to death, this would not prove that sticking a pin in the doll caused Mr. James to bleed.

(33) Distinguishing a fact from an opinion. A fact is a statement about an event for which we have considerable evidence, e.g., the planet Earth revolves around the sun. An opinion is a statement about an event for which we do not have sufficient evidence, e.g., the planet Earth is hollow.

(34) Distinguishing factual reports from inferences. Factual reports are statements about certain events based on factual information, e.g., the temperature today was 68 degrees. Inferences are statements about unknown events based on what we know, e.g., we inferred from a sound heard in our home, than an intruder had entered through the basement door.

(35) Recognizing and defining a problem. Recognizing a problem involves an intellectual awareness of a certain difficulty and an exploration of various means to resolve it. A problem should be defined in such a way that it has a possible solution.

(36) Using evidence to test beliefs. One means that can be used to test beliefs is to seek evidence that will substantiate them. This includes the use of observations, artifacts, documents, corroboration by other observers, and replication by experiments.

(37) Seeking explanations. An explanation is a process of determining why a particular event occurred. Why did the light go out in the bathroom? The light bulb burned out. Explanations assume the truth of certain generalizations. The generalization that all light bulbs that burn out will not light again is used in the explanation that this light bulb burned out. However, there are other explanations for this event that should also be explored and tested. There are various kinds of explanations, such as causal, teleological and empirical.

(38) An analysis of the appeal to "ancient wisdom". It is sometimes believed that the ideas of a great man in the past are true because he was a great man. However, great men have made false statements. Aristotle believed that the planet Earth was the center of the solar system.

(39) An analysis of the appeal to "old age". Parents often tell their children they know what is good for them because they have lived longer. Living longer does not necessarily mean that a parent possesses more knowledge or wisdom about a particular issue.

(40) Judging common sense. Common sense beliefs are beliefs shared by large number of people. Many people believe that a bull is infuriated by the colour "red". This is false, since a bull is colour-blind. A belief can be shared by many people, and yet still be false.

(41) Judging faith. The appeal to faith or steadfastness of belief is sometimes used to substantiate certain beliefs. However, one can have faith in something that is false, e.g., some students have faith that their teachers can be shared by many people, and yet still be false.

(42) Recognizing the fallacy of authority. This fallacy is committed when we use the prestige of an authority as the sole means of justifying a claim he has made. Authorities sometimes make statements about their field that are not based on any evidence. It should also be noted that if a person is an authority in one field, this does not mean he is an authority in other areas. Although Willie Mays may be a reliable authority about baseball, his remarks on the quality of a breakfast food are not those of a nutritional expert.

(43) Judging intuition. An intuitive belief is one which is claimed to be true because one feels it to be the case, or because it is considered to be self-evident. Many beliefs that were felt to be true have been discovered to be false, e.g., some students who feel they have failed a test, actually pass.

(44) An analysis of the appeal to immediate experience. An individual's immediate experience or perception is sometimes used to affirm the truth or falsity of a particular statement. But our immediate experience or perception of things can be distorted. Our first impression of people is sometimes inaccurate. A mirage is an example of how our senses can deceive us.

(45) Deduction. Deduction is the process of inferring from a set of statements or premises, a conclusion which necessarily follows. Syllogistic reasoning and "if-then" thinking are the most common forms of deductive reasoning. In deductive reasoning, certain rules need to be applied to an argument in order to determine whether it is valid or invalid.

(46) Induction. Induction is the process of inferring from certain facts, a conclusion that has a certain degree of probability. Descriptions, predictions, and explanations are some basic types of inductive inferences.

(47) Scientific method. The scientific method is a set of procedures used in the process of verification. It involves the formation of a problem, collection of data, formation of hypotheses, predictions, controls, observations, testing, deductive inferences, deriving conclusions, as well as other procedures.

(48) The consistent use of a principle in ethnics. It has been argued that euthanasia (mercy killing) is wrong, because it involves killing a human being and killing is wrong. The principle "killing is wrong" would have to be applied to all the beliefs of the individual who maintains this position in order to determine whether he is consistent. However, if this individual believes killing is not wrong during war or in an act of self-preservation, then he is being inconsistent.

(49) Justifying the standards used in ethnics. Some ethical disagreements are based on the fact that different standards are being used to evaluate an action. Is smoking good? Using the standard of health one individual might argue that smoking is unhealthy. Therefore, it is not good to smoke. Another individual might argue that smoking has an emotional satisfying effect. Using the standard of emotional satisfaction, we can conclude that smoking is good. We have a disagreement based on a conflict of standards. One might continue the argument by asserting that the standard of health, especially in a life or death situation, is more important than emotional satisfaction. Emotional satisfaction can be derived in other ways that are not injurious to the human body.

(50) The realization that an ethical dispute may not be resolvable. The basis of ethical disagreements are sometimes not differences in belief, but rather attitudes that are essentially emotive. Emotive attitudes are not always open to revision in light of factual presentations. One cannot always resolve this type of ethical disagreement, e.g., a dispute about the value of communism.

This is not an exhaustive list of all critical thinking skills. It is representation of the many different skills that students can learn in the elementary and secondary schools. Teachers need to determine at what grade level these individual skills can be mastered.

## APPENDIX III

**From:** Developing Minds (Costa, A.L. 1985) and
Thinking in the Classroom (Chance, P. 1986)

(From: Thinking in the Classroom)

### INSTRUMENTAL ENRICHMENT

**Principal developer:** Reuven Feuerstein, Ph.D., former Director of Psychological Services, Youth Aliyah, Jerusalem, Israel.

**Assumptions:** Students learn to think by means of "mediated learning experiences." A lack of such experiences may result in "cognitive deficiencies." Remediation should consist of providing mediated learning experiences.

**Goals:** To correct cognitive deficiencies such as impulsivity and lack of appreciation for accuracy; to replace a passive orientation toward the environment with an active one.

**Methods and materials:** Fifteen units consisting of paper and pencil exercises designed to correct cognitive deficiencies. One-hour classes meet three to five times a week for two to three years. Teacher leads discussion of exercises.

**Audience:** Ages eleven to adult. Used with various ability levels but best suited to those below grade level.

**Teacher qualifications:** Teacher training mandatory. Intelligence to meet the challenge of a complex and novel program.

**Benefits claimed:** Cognitive skills improve; students become less passive; general learning ability increases.

**Special problems:** Lack of face validity; little progress seen in first year; difficult to administer.

**Publisher:** University Park Press. Note: Do not contact publisher. Write to R. Feuerstein, 6 Karmon St., Jerusalem, Israel.

### Instrumental Enrichment (From: Developing Minds)

| | |
|---|---|
| Developer: | Reuven Feuerstein |
| Goal: | To develop thinking and problem-solving abilities in order to become an autonomous learner. |
| Sample skills: | Classification/comparison, orientation in space, recognizing relationships, following directions, planning, organizing, logical reasoning, inductive and deductive reasoning, synthesizing. |
| Assumptions: | • Intelligence is dynamic (modifiable), not static.<br>• Cognitive development requires direct intervention over time to build the mental processes for learning to learn.<br>• Cognitive development requires *mediated* learning experiences. |
| Intended audience: | Upper elementary, middle, and secondary levels. |
| Process: | Students do paper-and-pencil "instruments," which are introduced by teachers and followed by discussions for insight to bring about transfer of learning. The teacher becomes the mediating agent. The cognitive tasks in the materials of instruction are not subject-specific but parallel the subject matter being taught by the teacher. |
| Time: | Two to three hours a week (plus bridging to subject matter and life skills) over a two- to three-year period. |
| Available from: | Curriculum Development Associates, Inc.<br>Suite 414, 1211 Connecticut Avenue, N.W.<br>Washington, DC 20036 |

(From: Thinking in the Classroom)

## ODYSSEY

**Principal developers:** An international team of about fifty American and Venezuelan psychologists, educators, and government officials.

**Assumptions:** Intellectual performance depends upon abilities, methods, knowledge, and attitudes. These are best improved through dialogue and discovery learning.

**Goals:** To teach skills ("target abilities") needed for a wide variety of intellectual tasks. Includes creative-thinking skills, but emphasis is on reasoning.

**Methods and materials:** 99 forty-five minute lessons organized into six books. Students have three or four lessons per week over a period of two years. Lessons include dialogue and written exercises.

**Audience:** Fourth through sixth graders able to read the materials.

**Teacher qualifications:** Formal training is considered desirable and is offered by the publisher.

**Benefits claimed:** Improved performance on tasks requiring target abilities. Some improvement on academic aptitude tests.

**Special problems:** Unclear. Odyssey has not been field tested with American students.

**Publisher:** Mastery Education Corporation, Watertown, MA 02172.

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## ODYSSEY

(From: Developing Minds)

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| **Developers:** | A team of researchers from Harvard University, Bolt Beranek and Newman Inc., and the Venezuelan Ministry of Education. |
| **Goal:** | To teach a broad range of general thinking skills. |
| **Sample skills:** | Careful observation, classification, precise use of language, analogical reasoning, hypothesis generation and testing, problem-solving strategies, and decision making. |
| **Assumptions:** | • Performance of intellectually demanding tasks is influenced by various types of factors: abilities, strategies, knowledge, and attitudes<br>• Some, perhaps all, of these factors are modifiable.<br>• Teaching approach should ensure student participation and intellectual involvement. |
| **Intended audience:** | Middle level students. |
| **Process:** | Emphasis on discussion and student engagement in problem solving, reasoning, decision making, creative activities. Some paper-and-pencil exercises. Introspection on own thought processes. |
| **Time:** | Three to five 45-minute lessons per week. |
| **Available from:** | Mastery Education Corporation<br>85 Main Street<br>Watertown, MA 02172 |

From: (Thinking in the Classroom)

## PHILOSOPHY FOR CHILDREN

**Principal developer:** Matthew Lipman, Ph.D., Director, Institute for the Advancement of Philosophy for Children (IAPC).

**Assumptions:** Thinking well requires the ability to perform numerous reasoning skills, most of which are best learned through the use of language (i.e., dialogue).

**Goals:** To teach students to reason well and to enjoy thinking for themselves.

**Methods and materials:** Students meet three times a week for forty minutes to read, do exercises, and talk. Focus of the class is a novel in which the characters discover and model principles of reasoning in the process of exploring philosophical issues. Teachers use a variety of special techniques to model and elicit reasoning skills.

**Audience:** Materials available for grades three through twelve.

**Teacher qualifications:** A two-week IAPC workshop is considered minimal training. Teachers should have a philosophical bent.

**Benefits claimed:** Improved reasoning. More thoughtful approach to problems, including schoolwork.

**Special problems:** Some parents may object to the discussion of controversial topics; some students dislike the lack of simple answers.

**Publisher:** Institute for the Advancement of Philosophy for Children, Montclair State College, Upper Montclair, NJ 07043.

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From: (Developing Minds)

## Philosophy for Children

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|---|---|
| **Developer:** | Matthew Lipman |
| **Goal:** | Improve children's reasoning abilities by having them think about thinking as they discuss concepts of importance to them. |
| **Sample skills:** | Drawing inferences, making analogies, forming hypotheses, classification. |
| **Assumptions:** | • Children are by nature interested in philosophical issues such as truth, fairness, and personal identity.<br>• Children should learn to think for themselves, to explore alternatives to their own points of view, to consider evidence, to make careful distinctions, and to become aware of the objectives of the educational process. |
| **Intended audience:** | Children kindergarten through high school. |
| **Process:** | Students read special novels with inquisitive children as characters, followed by teacher-led discussion, using structured discussion plans, exercises, and games. |
| **Time:** | Three 40-minute periods per week. |
| **Available from:** | Institute for the Advancement of Philosophy for Children<br>Montclair State College<br>Upper Montclair, NJ 07043 |

From: (Thinking in the Classroom)

## PRODUCTIVE THINKING PROGRAM

**Principal developer:** Martin V. Covington, Ph.D., Professor of Psychology, University of California at Berkeley.

**Assumptions:** Productive thinking involves five kinds of thinking skills. Improvement in these skills may be accomplished through instruction in general strategies ("thinking guides"). Direct instruction and practice on complex problems are essential. Development of good attitudes fundamental to success.

**Goals:** To teach use of sixteen thinking guides helpful in productive thinking.

**Methods and materials:** Students read fifteen booklets with comic book format, and practice thinking guides by answering questions confronting story characters. Class discussion of booklet exercises. Usually taught in one semester.

**Audience:** Primarily fifth- and sixth-grade students; suitable for all but the slowest learners.

**Teacher qualifications:** Formal training considered unnecessary.

**Benefits claimed:** More original ideas, persistence at problem solving, curiosity; use of guides in attacking problems.

**Special problems:** Vagueness of guides. Some organizational problems in material. Perhaps too many guides.

**Publisher:** Charles E. Merrill Publishing Co., 1300 Alum Creek Dr., Columbus, OH 43216.

From: (Thinking in the Classroom)

## CoRT THINKING LESSONS

**Principal developer:** Edward deBono, M.D., Ph.D., Director, Cognitive Research Trust, Cambridge, U.K.

**Assumptions:** There are two stages in thinking: perception and analysis. Poor thinking often is due to errors in perception, rather than analysis. Perceptual skills are neglected by schools and therefore deserve greater attention in thinking programs.

**Goals:** Although analytical thinking is covered, the emphasis is on improving perceptual thinking through the use of "tools," such as PMI (Plus, Minus, Interesting) and C&S (Consequences and Sequels), which draw attention to the perceptual stage of thinking.

**Methods and materials:** Practice through group and class discussion in use of perceptual tools on real-life problems. One fast-paced lesson per week for two years.

**Audience:** Most commonly used with children between nine and twelve; all ability levels.

**Teacher qualifications:** Formal training is optional; for information on workshops, contact Edward deBono Resource Center, 4 Canal Road, Pelham Manor, NY 10803.

**Benefits claimed:** Students become more flexible, are likely to see more sides to an issue, more alternatives to a problem.

**Special problems:** Older students find tools obvious; some object to tool acronyms; repetitive activities may become boring.

**Publisher:** Pergamon Press, Inc., Fairview Park, Elmsford, NY 10523.

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## CoRT (Cognitive Research Trust) (From: Developing Minds)

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|---|---|
| **Developer:** | Edward de Bono |
| **Goal:** | Teach thinking skills useful to everyone in and out of school. |
| **Sample skills:** | PNI: Positive, Negative, Interesting<br>CAF: Consider All Factors |
| **Assumptions:** | • Lateral thinking, unlike vertical thinking, is not necessarily sequential, is unpredictable, and is not constrained by convention.<br>• It is not necessary to be right at every stage of the thought process nor to have everything rigidly defined.<br>• Intelligent people are not necessarily skillful thinkers. |
| **Intended audience:** | Ages eight to 22, all ability levels. |
| **Process:** | Students practice "operations" following "lesson notes." Teachers present and monitor the exercises. |
| **Time:** | One lesson 35 minutes or longer per week for three years. |
| **Comments:** | Evaluation results suggest that the program leads students to take a broader view of formally posed problems. |
| **Available from:** | Pergamon Press, Inc.<br>Fairview Park<br>Elmsford, NY 10523 |

## BASICS

From: (Developing Minds)

**Developers:** Sydelle Seiger-Ehrenberg and Lyle M. Ehrenberg (based on original work by Hilda Taba)

**General goal:** Students use appropriate thinking strategies to achieve the five major types of learning objectives of any curriculum: facts, concepts, principles, attitudes, and skills. They apply these thinking strategies in dealing with outside-of-school learning and life situations.

**Sample skills:** Observing, retrieving, comparing, contrasting, grouping, concept formation, classifying, inferring, generalizing, anticipating, making choices, attitude formation, skill development.

**Assumptions:**

- Practice of thinking skills out of context is not likely to result in consistent use of appropriate thinking in learning and life situations.
- Achievement of curriculum learning objectives and transfer to life situations is most likely to occur if students have consistent practice in the use of appropriate thinking as they learn.
- All curriculum objectives, regardless of specific content, can be classified by the type of learning (and thinking) required of students.
- Thinking strategies can be incorporated into any curriculum so that students not only achieve the objectives better and faster but also learn strategies for learning, problem solving, planning, and so on.
- Short of building or revising curriculum to incorporate appropriate thinking strategies, teachers can be trained to build such strategies into their teaching of the existing curriculum.

**Intended audience:** Suitable for preschool through adult learners.

**Process:**

- In the *curriculum model* curriculum is developed or revised to include thinking strategies as the process for achieving the learning objectives.
- In the *staff development model* teachers are trained to plan and conduct lessons that incorporate the use of appropriate thinking strategies.

**Time and Teacher Training**

- The *curriculum model* is developed and implemented in a three- to five-year process that includes periodic training and follow-up as curriculum is written and tested.
- The *staff development model* requires a minimum of 15 to 20 full days of training over a two-year period with one-year periodic follow-up.

**Available from:**

ICI Services, Ltd.
301 South Third Street
Coshocton, OH 43812
(614) 622-5344/5341

Adapted From: (Developing Minds)

## Learning to Learn

| | |
|---|---|
| Developers: | Marcia Heiman and Joshua Slomianko |
| Goals: | To improve students' academic performance in content areas across the curriculum; and to improve students' skills in reasoning, reading, writing, and listening. |
| Sample skills: | Generating questions from notes, books, handouts; constructing information maps and flowcharts; reading for examples; reading to solve problems; using an editing checklist for math problem solving and written composition; systematic problem solving. |
| Assumptions: | All successful learning has the following elements. The learner is:<br>• Generating questions, raising and testing hypotheses.<br>• Breaking down complex tasks and ideas into manageable components.<br>• Devising informal feedback mechanisms to assess progress toward goals.<br>• Directed toward achieving specific goals. |
| Intended audience: | Junior and senior high school students. |
| Process: | In junior and senior high school, content area teachers incorporate LTL activities into classroom and homework assignments. In senior high, students take a year-long course in which they adapt the LTL skills to all their content area courses, learn the principles underlying LTL, and devise LTL exercises based on these principles. |
| Time: | No extra time when LTL is part of classroom instruction since the method helps students master the content material in an efficient way. A year-long course at senior high level. |

Teaching Training: No specialized training specified

Available from: Learning Skills Consultants
Box 495, Cambridge, MA 02138

## Creative Problem Solving (CPS)

Adapted from: (Developing Minds)

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| **Developer:** | Sidney J. Parnes, based on Alex F. Osborn |
| Goals: | Develop abilities and attitudes necessary for creative learning, problem sensing, and problem solving. |
| Sample skills: | Setting goals and objectives; sensing problems, challenges, and opportunities; searching out data; defining and analyzing problems; generating ideas; discerning criteria for effective evaluating; developing and implementing solutions; developing feedback systems; planning and gaining acceptance; anticipating new challenges from actions taken. |
| Assumptions: | • Creativity involves the *application* of knowledge, imagination, and judgment to learning, problem sensing, and problem solving.<br>• Everyone has the capacity, at their own mental level, for using creative approaches to learning, problem sensing, and problem solving.<br>• Continuing practice in using these approaches leads to ever-increasing proficiency, whether the person is mentally retarded, average, or gifted.<br>• CPS processes should be taught deliberately, both as general thinking skills and as applications to learning within all subject matter areas. |
| Intended audience: | Middle (especially for the gifted) and secondary levels (all). (Lower level materials based on CPS available from D.O.K. Publishers, Buffalo, N.Y.) |
| Process: | Students use activity book for practice exercises to strengthen CPS processes, under direction of the teacher using an instructor's guidebook. This guidebook offers additional exercises, readings, film listings, bibliographic sources, and test sources. Alternatively, students do independent self- or group-study and practice with specially designed test. Transfer of learning is emphasized in all materials. |
| Time: | A variety of flexible time patterns are suggested in the teacher's guide. Material is programmed for instructional blocks of approximately one hour. Plans are suggested for programs as short as eight hours or as long as two years. Programs are based on extensive research and field testing. |
| eacher Training; | No specialized training specified |
| vailable from: | Creative Education Foundation 437 Franklin Street, Buffalo, NY 14202 |

(Adapted from: Developing Minds

## Guided Design

| | |
|---|---|
| **Developer:** | Charles E. Wales |
| **Goal:** | To teach students the decision-making process and how to apply the subject matter they learn. |
| **Sample skills:** | Identify and solve open-ended problems; think critically; generate, classify, and explore alternatives; develop analogies; analyze issues; find the causes of problems; make careful distinctions; anticipate potential problems; and deal with issues of truth, fairness, and different viewpoints. |
| **Assumptions:** | Knowledge is a means, not an end; a necessary but insufficient tool for success after graduation. It is the ability to apply knowledge that is crucial. |
| **Intended audience:** | Upper elementary through college and adult learners. |
| **Process:** | The "complete" decision-making process is modeled step by step in slow motion using printed instruction-feedback materials. Students use current subject matter as they make decisions. The teacher is a mediator and manager. |
| **Time:** | Varies. There should be regular practice in at least one course at every level each term. |
| **Teacher Training:** | No specialized training specified. |
| **Available from:** | The Center for Guided Design, Engineering Sciences Building<br>West Virginia University<br>MORGANTOWN, WV 26506-6101 |

## Project IMPACT

Adapted From: (Developed Minds)

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|---|---|
| eveloper: | S. Lee Winocur |
| oals: | To improve students' performance in mathematics and language arts by facilitating their acquisition of higher-level thinking skills. |
| ample skills: | Classifying and categorizing, ordering, identifying relevant and irrelevant information, formulating valid inductive and deductive arguments, rendering judgments. |
| ssumptions: | • All students are capable of higher-level thinking.<br>• Thinking skills can be taught.<br>• Thinking skills can be learned<br>• Thinking skills are basic to the learning process.<br>• Thinking is best introduced in a social context.<br>• Thinking skills must be related to the curriculum. |
| ntended audience: | Middle and secondary levels. |
| rocess: | Students' basic skills in language arts and mathematics improve through learning activities that include a critical thinking component infused into content area lessons through (1) a sequential and cumulative universe of critical thinking skills designed to help students reason, (2) a model lesson format, and (3) ten teaching behaviors that label and reinforce students' use of thinking in an interactive environment. |
| ime: | Two to three hours per week. |
| eacher Training: | Availability of all materials is contigent uponmandatory 3-day teacher training sessions offered by developer. |
| vailable from: | S. Lee Winocur<br>National Director<br>Project Director PROJECT IMPACT Orange County Department of Education Box 9050m Costa Mesa CA |

Adapted from:(Developed Minds)

## Strategic Reasoning

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| Developer: | John Glade, based on Albert Upton's "Design for Thinking" model. |
| Goal: | Teach the conscious thinking skills students must have to function effectively in school and in real life. |
| Skills: | Thing-making (identification)<br>Qualification (description)<br>Classification (organization)<br>Structure Analysis (part-whole relations)<br>Operation Analysis (sequencing)<br>Seeing Analogies |
| Assumptions: | • Six thinking skills form the fundamental core of *all* thinking and problem solving.<br>• Instruction in the six thinking skills improves both school and real-life performance and success.<br>• Thinking instruction must be integrated with, not separated from, regular classroom learning. |
| Intended audience: | All types of students from the 4th grade up. |
| Process: | Students do group activities and paper-and-pencil exercises. Teachers lead discussions of problem-solving processes and rationales. Program materials provide for transition from developmental IQ-type exercises to subject-matter exercises, then to life applications. |
| Time: | One period per week. |
| Teacher training: | Optional: Program contains all materials necessary to achieve its instructional goals. |

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Adapted from: (Developed Minds)

## Structure of the Intellect (SOI)

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| veloper: | Mary Meeker (based on Guilford) |
| al: | Equip students with the necessary intellectual skills to learn subject matter and critical thinking. |
| nple skill: | NMI: coNvergent production of<br>seMantic<br>Implications (choosing the best word) |
| sumptions: | • Intelligence consists of 120 thinking abilities that are a combination of *operations* (such as comprehending, remembering, and analyzing); *contents* (such as words, forms, and symbols); and *products* (such as single units, groups, relationships).<br>• Twenty-six of these factors are especially relevant to success in school.<br>• Individual differences in these factors can be assessed with the SOI-LA tests and improved with specifically designed SOI materials. |
| nded audience: | All students and adults. |
| cess: | Students use materials (some three dimensional) prescribed for them based on a diagnostic test. Computer software gives analyses and prescriptions. |
| ne: | Varies, but can be 30-minute lessons twice a week until abilities are developed on post-assessment. |
| cher training: | Extensive retraining required to administer diagnostic instruments and utilize program methodology |

SOI Institute 343 Richmond Street , El Segundo, CA 90245

(Adapted from: Developing Minds)

## Future Problem Solving

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| Developer: | E. Paul Torrance (based on the work of Alex Osborn and Sidney Parnes) |
| Goals: | Develop creative problem-solving skills while learning about the future. |
| Sample skills: | Creative problem-solving process, communication skills (verbal and written), teamwork skills, research techniques, critical and analytical thinking. |
| Assumptions: | • Problem-solving skills are necessary to function effectively.<br>• In order to prepare for the future, young people need to consider issues related to that future.<br>• Students can and should be taught to think more creatively. |
| Intended audience: | Regular program: grades 4-12. Primary division: K-3. |
| Process: | Students in teams of four follow a multiple step problem-solving process: gathering information about a topic, brainstorming problems from a given situation, identifying the major underlying problem, brainstorming solutions, selecting criteria by which to evaluate solutions, and evaluating the solutions to determine the best one. |
| Time: | Varies with individual schedules; one hour per week is normal. |
| **Teacher Training:** | Specific training of teachers and student participants required. |
| **Available from:** | Future Problem Solving Program Coe College, CEDAR RAPIDS, IA 52402 |